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OFFICIAL PROCEEDINGS OF THE
THIRD ANNUAL CONVENTION
OF THE

INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION

HELD AT
HOTEL SEELBACH
Louisville, Ky.
April 27, 28 and 29, 1909

33188

The Next Annual Convention

Important Notice to Members!

Exercising Authority Conferred by the Constitution and By-laws, the Executive Board has voted to change the place for the next Annual Convention of the Association from Cincinnati to Niagara Falls. The dates, place and hotel arrangements and other details will be made known in a special announcement to be hereafter issued. :-: :-: :-: :-:

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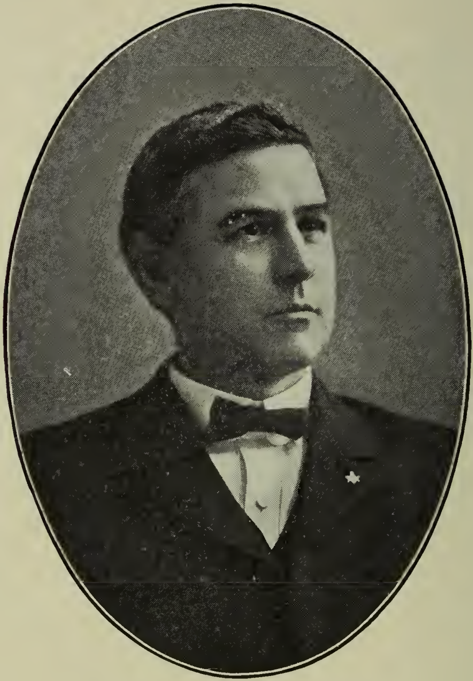

ARTHUR E. BROWN
President

621.1806
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1909

PROCEEDINGS

OPENING SESSION.

WMS 12Je'15

The Third Annual Convention of the International Master Boiler Makers' Association was called to order at 10:30 o'clock on the morning of April 27th, at the Seelbach Hotel, Louisville, Kentucky, by President P. J. Conrath.

The President: We will open our meeting, as is usual, with prayer by the Rev. Dr. H. A. Porter of the Walnut Street Baptist Church of this city.

Holy! Holy! Holy! Lord God Almighty, Which was and Which is and Which is to come: before Thee this morning the high angels hide their faces, unable to withstand Thy glory and Thy brightness, and it becomes us as we approach Thee this day to bow our heads before the great and lustrous throne. We thank Thee that a way of approach has been made for us to the throne of God, and that we, mortal men and women though we be, may approach the omnipotent and holy One. Let us come to Thee this morning with thanksgiving and let us be like that one of the ten who were healed who came back and fell at the Master's feet and gave thanks. Unto Thee, O Lord, we give thanks. Unto Thee we give thanks. Help us to thank Thee this morning for the blessings that Thou hast poured into our lives, as the sunshine falls upon the earth, as the rain waters the ground. Sometimes we are unthinking of Thy blessings. May they appeal to us in new glory and new beauty this day as we think upon them. We thank Thee for the blessing of human life. We thank Thee for the homes Thou hast given us. Many of us here present are far away from home. There is no better gift than the gift of love. May we learn to treasure it better and may we be grateful to Thee for this matchless blessing. We thank Thee for the gift of work. There is no blessing that comes to us that overmatches this, the opportunity to do our work. We thank Thee for the men in this city, the business men who are princes in the sight of God as well as of men. We thank Thee that they are men of God as well as men of affairs, men who remember they are doing business for eternity as well as for time. Wilt Thou lift up our ideals of our work. Every work has its noble and lofty ideal, and may this great international organization, that stretches from the North to the South, remember that in their meeting and in their work they are helping to bring to pass the final brotherhood of man. May heart beat to heart in this Convention; may hand clasp hand in the clasp of brotherhood. We thank Thee for the bonds that are reuniting us in these latter days. May they be strengthened by this Convention, and grant that we may set our faces homeward again with new purposes pulsing within us, with new ideals shining before us, and set ourselves to the tasks that Thou hast given us with new ardor and with new purpose. Wilt Thou guide the deliberations of this assembly with blessings upon him who presides and upon those who participate, with blessings upon those who will speak this morning, men who represent our city, and so may we go away feeling it was good to be here and blessed because of our coming. We ask it in the name of Jesus, Amen.

A. N. LUCAS
First Vice-President

The President: Ladies' Auxiliary and fellow-members of the Master Boiler Makers' Association: I take great pleasure in introducing the Honorable James F. Grinstead, Mayor of the city of Louisville, who in evidence of his interest in us, is here in person this morning. It is to us a great honor, and he comes to bid you welcome to the city of Louisville and his people. (Applause.)

ADDRESS OF WELCOME,

BY MAYOR JAMES F. GRINSTEAD.

Mr. President, Ladies and Gentlemen:

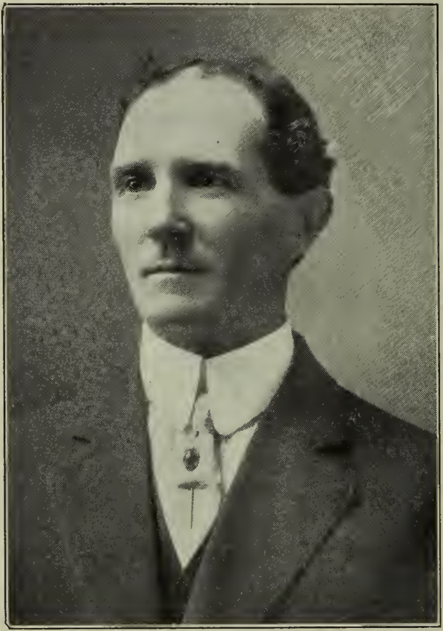
I have been called upon by the members of the local committee to extend to you a welcome to the city of Louisville. I assure you that it is with very great pleasure I am here. I have no doubt but that you have already had a hearty greeting from your committee and that you already feel that you are at home in Louisville. The city of Louisville is honored by your presence. We are delighted to have an association such as yours hold its sessions in your city. The city of Louisville is a great city, and the citizens of Louisville are very proud of it, and we have no doubt, my friends, that before you leave here you will be much pleased with what you see and hear and do in the city of Louisville and have done to you too. We have a large city, something like 260,000 population. We cover about 23 square miles of territory. We have adjacent to our city, belonging to the city, three very large parks, and I hope that all of you will take occasion to visit our parks and enjoy the trees and the shrubbery and the pure air. Your Association, I have no doubt, will have a profitable session here. Your officers tell me that your Association has profited by its annual meetings, and I know that it is the rule of associations to profit by the interchange of views and the renewal of acquaintances. And now on behalf of the city of Louisville, as its Chief Executive, I bid you a very hearty welcome to our city. We are situated, as you know, nearly in the middle of this great country. We are only a short distance from the center of population, perhaps not more than 150 miles from that center. Our gates swing open every way and we are glad to have all the people from all the world come within our gates. We will let you stay just as long as you want to stay, and will let you come again when you want to come, and there will be no hindrance to your going when you get ready to go; all we ask of you in the world is to enjoy yourselves the best you can while you are here—and to behave yourselves, for if you don't our police will get you sure. (Applause.)

The President: Mr. George Wagstaff, past president, will respond.

RESPONSE OF PAST PRESIDENT GEORGE WAGSTAFF.

Mr. President and Gentlemen of the Convention:

It becomes my very great pleasure this morning to respond to the Honorable Mayor of this city. One year ago when Mr. Brown worked so hard to induce us to come to Louisville, many of our people had very grave doubts indeed as to whether the Southern hospitality of this city would overcome the want of places to go to for enjoyment; but in thinking the matter over during the year, I believe that most of us have come to the conclusion that Louisville is not a very bad place to be in after all. And now, after having the city practically given to us, as the Mayor has just told us, there does not seem to be any good reason why we should not have just as good a session here as we have had in the past in any other city. I have visited Louisville a few times myself, and I know that it is a very agreeable place in which to be. The members of our Association are so sociable that I think they can enjoy themselves most anywhere. I know you will agree with me when I thank the Honorable Mayor for



CHARLES P. PATRICK
Second Vice-President

his kindness in coming to speak to us this morning and turning us loose. It does not matter about the key; we have that. We own the town for a while, and I am sure we will not disgrace ourselves. On behalf of this organization, I take great pleasure in thanking Your Honor for being with us and giving us the privileges of your city.

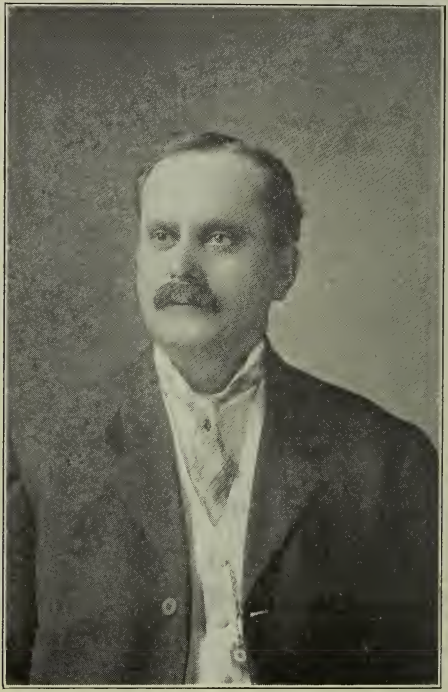
Mayor Grinstead: I thank you. (Applause.)

The President: Ladies and fellow members of the Master Boiler Makers' Association, I take great pleasure in introducing Mr. Frederick W. Keisker, President of the Commercial Club of Louisville. (Applause.)

ADDRESS OF THE HON. FREDERICK W. KEISKER.

Mr. President and Ladies and Gentlemen:

It is my great privilege and honor to extend to you this morning a very hearty and a very cordial welcome on behalf of the Louisville Commercial Club, the largest business organization in this country, and having a membership of more than 3100. Our club, ladies and gentlemen, appreciates the meaning to our city of such a body as this within our borders. You have here representatives from Canada, Mexico, from California and from Massachusetts, covering the entire country, and an organization that has at heart and is interested most largely in the commercial development of a city must appreciate what it means to have such representatives from every part of our country gathered here. The last gentleman who spoke referred to the invitation extended you at your last meeting. Our honored fellow citizen and friend, Mr. Arthur W. Brown, with the fog horn voice (laughter and applause) extended to you our invitation, and he, like all other representatives who go out representing the commercial organization of our city to invite our friends to be our guests, was given no restriction or restraint whatever as to what promise he should make. I am here, ladies and gentlemen, to assure you that Mr. Brown, his committee, and the commercial organizations of Louisville will back up any claim he has made. and make you feel welcome and make you thoroughly enjoy yourselves while you are here with us. (Applause.) It is particularly gratifying for us to note, gentlemen, that you have brought with you the ladies. As proverbial, a Kentuckian is most pleased and proud when he can dispense hospitality, and I want to assure you that when there are ladies among the guests, there is an added zest and added pleasure and added honor. (Applause.) We are glad that there are so many of your ladies with you, because while the ladies are enjoying themselves, as they shall—our committee will see to it—the gentlemen can be attending to their business. You have come not only for a day like some of the conventions who meet with us, you have come to stay four or five days and the presence of the ladies here shows us that many of you will not be rushed to get away, as you might be if the ladies were at home. (Applause and laughter.) Having the ladies with you, as I said before, gentlemen, is an added honor which we thoroughly appreciate. I do not want to detain you any longer now, but we are glad that you have come at this season of the year. As our Mayor has said, our parks are at their best, and I might add for the benefit of some of those present that our mint is very fragrant just at this time of the year. (Laughter.) We will be glad to have you enjoy and partake of everything that the city of Louisville has; our houses, our markets, our stores, our parks, everything for the time being is yours, and emphasizing and endorsing all the statements of His Honor, Mayor Grinstead, for the Louisville Com-



H. L. WRATTEN
Third Vice-President

mercial Club, I want again to extend to you a most hearty and cordial welcome. (Applause.)

The President: Mr. Goodwin will respond.

RESPONSE OF MR. J. T. GOODWIN.

Mr. President, Mr. Mayor, Mr. Kiesker, Ladies and Gentlemen:

I am sure that I voice the sentiment of this convention when I say that we are proud of the distinguished honor of being in the beautiful city of Louisville and having such warm words of welcome as we have heard this morning. I recall very easily that in Detroit last May when our able and worthy Vice President, Mr. Brown, placed Louisville in nomination. I do not think I ever heard a man appeal to a convention more earnestly than he did in behalf of this city. He said to us:

"We are located down there on the banks of the Ohio river, on the other side we have the Green river. The hospitality of those people down there is greater than you have ever seen."

We would have the distinguished gentlemen that have just spoken mindful of the fact that we are very happy indeed to be here. We realize that the hospitality of this city cannot be excelled in any city of the Union. In behalf of this convention we extend a cordial and courteous invitation for them to be with us whenever possible; that we would be very glad to have them here, as we are satisfied their presence will be of material help to us. And as far as the ladies are concerned, of course, I want to say that we have them with us every time we meet. They are our wives and our sweethearts and our daughters, and consequently we feel that they add charm and luster to our meetings. In conclusion, permit me to thank the President of the Commercial Club for his kind words to our Association. (Applause.)

The President: Ladies and fellow members of the Master Boiler Makers' Association. I take great pleasure in introducing Mr. Theodore H. Curtiss, Superintendent of Machinery of the Louisville & Nashville Railroad.

ADDRESS OF MR. THEODORE H. CURTISS.

Mr. President, Ladies and Gentlemen:

It is a great honor to be invited to say a few words before you. I feel that the city of Louisville is to be congratulated upon having this convention here. I hope you will all enjoy yourselves in the parks, in the hotels and other places of our city.

I wish to impress upon the members of the Association the importance of that which they are here for—to consider the boiler, which is for locomotives most especially. I want to urge upon you the necessity of looking into the different elements which enter into boiler construction. The boiler maker should not limit his energies and his work to repairing the boiler. We would feel very badly if the doctor came to our house only to make us so we could walk again; we want him to make us well, so we will not be sick; likewise the boiler. We hope the boiler maker will so consider the locomotive that he will eliminate the defects in the boiler and give us something for the locomotive that we can rely on more than we can to-day. The boiler of a locomotive is its principal part. You may run with one cylinder on a locomotive; you may run with one driving wheel shy, but I never heard of one running with one flue gone. (Applause.) Likewise the boiler is a brace to the whole locomotive. Think of how the locomotive frame is braced by the boiler. We do not put the boiler braces on to hold the boiler up, we put the braces on to save the frame and to save the engine.

T. W. LOWE
Fourth Vice-President

But that is not the principal part. The principal part of the boiler is to be something that will last as long as the engine, from one shopping to another. Lately, say in the last ten years, there have come to us larger fire boxes to give more grate area for heating surface, but with that we have a shorter life of the fire box. I recall some locomotives that are only two years old, and they represent a type largely used in the United States, that their fire boxes are now needing renewal, while there are engines that have been doing the same service with a little difference in the fire boxes, that are running from four years to five years before renewal of the box. Therefore it becomes the boiler maker to look in and find the cause for this rapid deterioration of the fire boxes. Some say it is the boiler material. I think that is nonsense. It is the construction of the boiler. Some say it is the high duty. In closing, I want to urge upon you the necesssity of looking into the construction of the boiler and to give us something that will last as long as the machinery, that is, from shopping to shopping.

I want to extend to you all, the ladies included, an invitation to visit the Louisville & Nashville railroad to visit their shops at South Louisville. I want all to come who will. Mr. Brown, our worthy boiler maker, has been putting on a few touches, I think. Things look pretty nice out there, and he keeps them that way all the time; but they are a little bit polished up now, and I assure you I want you all to come. I want the supply men to come too. The gates will be open, and we extend to you a hearty welcome. I thank you. (Applause.)

The President: Mr. J. H. Smythe will respond. I don't think he needs an introduction. I believe he is pretty well acquainted with all of you.

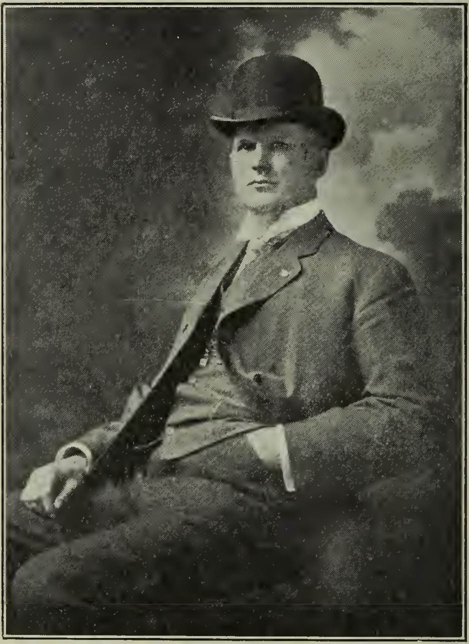
RESPONSE OF MR. JOHN H. SMYTHE.

Mr. Curtiss, Mr. Chairman, Ladies and Gentlemen:

I know that it is an honor to listen to and to have a representative of the Louisville & Nashville Railroad Company with us this morning. The speakers before Mr. Curtiss represented the city. Mr. Curtiss represents the mechanical end of the city, and I assure you that we appreciate his remarks. Also the hearty invitation to visit the Louisville & Nashville shops. Speaking of the advantages that Louisville has, I know that one has been left out in enumerating them, and it is this: We get a mud bath whether we want it or not. (Applause and laughter.) We appreciate the cordial reception our ladies were given by the previous speaker.

Mr. Curtiss has given us food for thought. He has spoken about the boilers. He struck the right note. He said it is not the material, but the way they are designed, and gentlemen, we have food for thought. We are here this morning, not as a body of men who know it all, but we come together acknowledging to one another that we do not know it all; we want to know what the other fellow knows. It is not necessary for me to take your time. We will take up this matter and talk it over in convention. I take great pleasure in thanking Mr. Curtiss for his very cordial remarks, and assure him that we will accept his invitation and go out and see the beautiful shops of the Louisville & Nashville Railroad. I thank you. (Applause.)

The President: Ladies and fellow members of the Master Boiler Makers' Association, I have the pleasure of introducing Mr. H. C. May, Master Mechanic of the Louisville & Nashville shops.



GEORGE W. BENNETT
Fifth Vice-President

ADDRESS OF MR. H. C. MAY.

Ladies and Gentlemen:

Our Honorable Mayor has extended to you the welcome of the city, Mr. Kiesker has spoken in behalf of the Louisville Commercial Club, and Mr. Curtiss in the interest of the railway.

I feel that there is very little for me to say along lines of welcome, other than I will be glad indeed to have you, collectively or individually, visit our plant at South Louisville, where I assure you we will do everything possible to make it pleasant and profitable. I have so arranged it out there that your official badges are passports over the premises and in all buildings. I sincerely hope you will come out and see everything we have and exchange ideas with us, that we may both profit by your visit.

Your program and the advance copies of the papers were kindly handed to me by Mr. Brown, and I have had the pleasure of reading over your papers. They are instructive, and you have some points to bring up before this convention that are of vital importance to the maintenance of boilers, which are, as we all know, the heart of the locomotive. I sincerely hope in dealing with these that you will give them your best thought, for we in charge of shops like to have our boiler maker foreman keep us straight, in decisions and recommendations, so far as the boiler is concerned, assuming that he by his past experience and knowledge knows more of that particular part of the locomotive than we who handle the machinery in general.

Considering the maintenance and work on our large engines, it is well to consider quality ahead of quantity. After visiting our plant may you all feel determined to go back to your respective places and profit by what you have seen and heard, giving your superiors the benefit of your presence here at the convention and what knowledge you have obtained by being in attendance. I thank you. (Applause.)

The Chairman: Mr. T. C. Best, who needs no introduction, will respond.

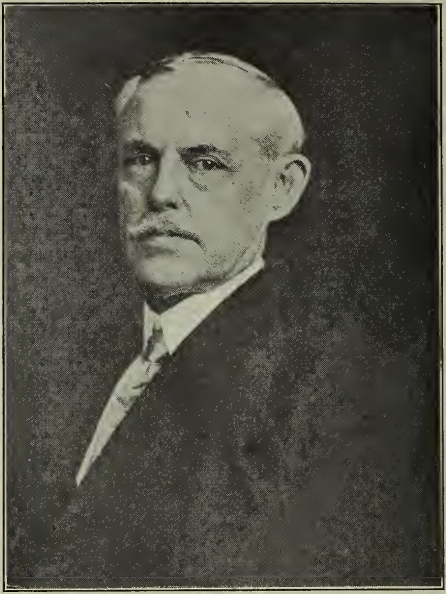
RESPONSE OF MR. THOMAS C. BEST.

Mr. President, Ladies and Gentlemen:

It has been my experience through life that the little fellow has always been chosen to do the hard work. (Laughter.) I realize that it requires more time than can be given to make an address on mechanical work—that subject we know so little about; hence I will leave this for others to do at a later hour when time will permit.

I feel a great deal this morning like the old Irishman that had been out of employment for a long time, who was sitting in the kitchen smoking his clay pipe when a loud rap came at the door. He did not know whether to answer the call or not, and after a moment's hesitation, said: "By Garrows, if I go to the door it's the landlord after the rent, and if I don't go it's a job." (Laughter.) I am a good deal in the same fix, I don't know whether to back out or go ahead.

I attended a meeting a short time ago in Chicago where one of the attendants stated that it was thought that his litttle boy had appendicitis, and at home the parents were discussing what they thought was the best thing to do with him. His father said, "Cut it out;" but the mother, who looked at it from a more serious view point, said, "Oh, forget it."



HARRY D. VOUGHT
Secretary

We have heard a great deal of talk from time to time concerning boilers, particularly locomotive boilers. I wish from an Association standpoint that there were more stationary men with us today, but there is a reason for their absence, as they must necessarily pay their railroad fare and other expenses, while many of the railroad men do not. This reminds me of an incident which occured in a small town I visited last summer in Iowa. While walking around the show ground with a number of friends, we observed at the door of the side show a big fellow dressed in a very fine costume, yelling at the top of his voice, "Come in and see the moose, it's only ten cents." A farmer and his wife stepped up close to him, when he said again, "Come in, it's only ten cents." The farmer shook his head negatively. "Why, come in, it's only ten cents." The farmer said, "I can't afford it, I have my wife with me." "Oh, well, that's only twenty cents, come on in and see the moose." "But," said the farmer, "I have my family with me." By this time quite a crowd had gathered around the farmer and his wife. The man with the fancy garment then said, "You don't mean to tell me that all these are your children." "I do," said he. "For goodness sakes, how many have you?" "Nineteen." "Then," said he, "stay right here and I will bring the moose out to see you." (Laughter.)

I am sorry that we cannot take the convention to more of the contract men, as the presence of both railroad and contract boiler makers is very essential for the success of an Association such as ours, covering, as it does, such a large range of work, and we cannot help but regret that it is the expense and this alone which prevents these much interested men from attending in larger numbers.

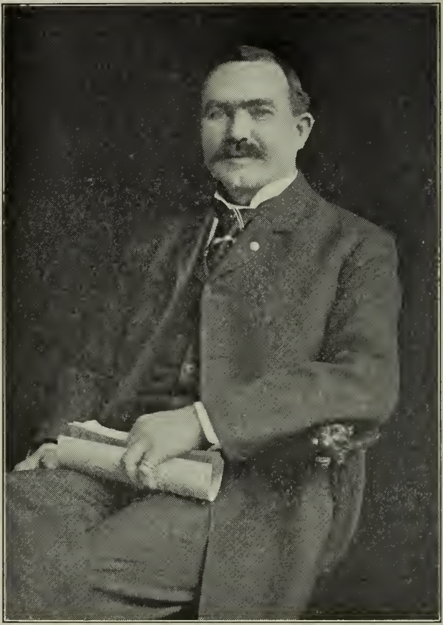
I will take up but just a few minutes more of your time, because we have too little time allotted for what we hope to accomplish at this convention. I want to thank Mr. May and the other speakers for the splendid services they have rendered us this morning, and I might add further that this is the first time in April that I ever saw May. (Laughter.) Now, ladies and gentlemen, I hope you will enjoy yourselves at this convention. Personally I am pleased to see so many ladies present this morning and certainly hope that your visit here will be one continuous round of pleasure. I thank you all for your appreciated attention, and the officers for the honor they have bestowed upon me, by this opportunity to assist in welcoming you to the beautiful city of Louisville. (Applause.)

The President: I believe Mr. Brown needs no introduction. (Applause.)

ADDRESS OF VICE-PRESIDENT ARTHUR E. BROWN.

Mr. President, Gentlemen of the Convention and Ladies:

I don't know that it would be necessary for me to try to illustrate to you just how I feel this morning. Overwhelmed with joy, if you please. As this convention season dawned here yesterday morning, I was laboring strongly under the impression that the sun would shine bright in my old Kentucky home. I still have that confidence that this cloud will blow away and the sun will cast its rays upon each and every one of you. (Applause.) This privilege, my friends, while I am not booked for any remarks, I have asked for. How could I resist the temptation of imposing upon the Committee of Arrangements of this convention in order to profoundly thank you from the bottom of my heart for the honor that you have shown me in selecting this city for your convention. If I did not acknowledge it, friends, I would think you would never forgive me. I hope your sojourn in Louisville will be all that could be expected. I am perfectly satisfied to double the dose, and as the slogan of Kentucky runs, "We're off." If you don't believe it, spend the following week with us at Churchill Downs where the races begin, and I know you will enjoy it.



FRANK GRAY
Treasurer

I want to ask a favor of this assembly, the gentlemen in particular, who present themselves at the South Louisville shops, and hope it will be observed from first to last. It is this: "Don't have your cigars lighted as you come in." It is sometimes hard for us to call the attention of our visitors to that rule, but we are here to exercise our duty. I hope you will all enjoy the hospitality extended by our railroad's superintendent of machinery, Mr. Curtiss, and also Mr. May. I know we have things there that will be of interest to you. Possibly you will have something to offer us. We stand ready for criticism. We are ready to accept and thankfully receive. Your badges will be a signal of recognition. Will you all please be the possessor of one? I hope you will all join me, the ladies if they please, and go through our shops at South Louisville. Friends, again I do thank you, and also on behalf of those who have participated to make this opening successful. In conclusion permit me to add that I hope the weather will be favorable. I thank you for your attention. (Applause.)

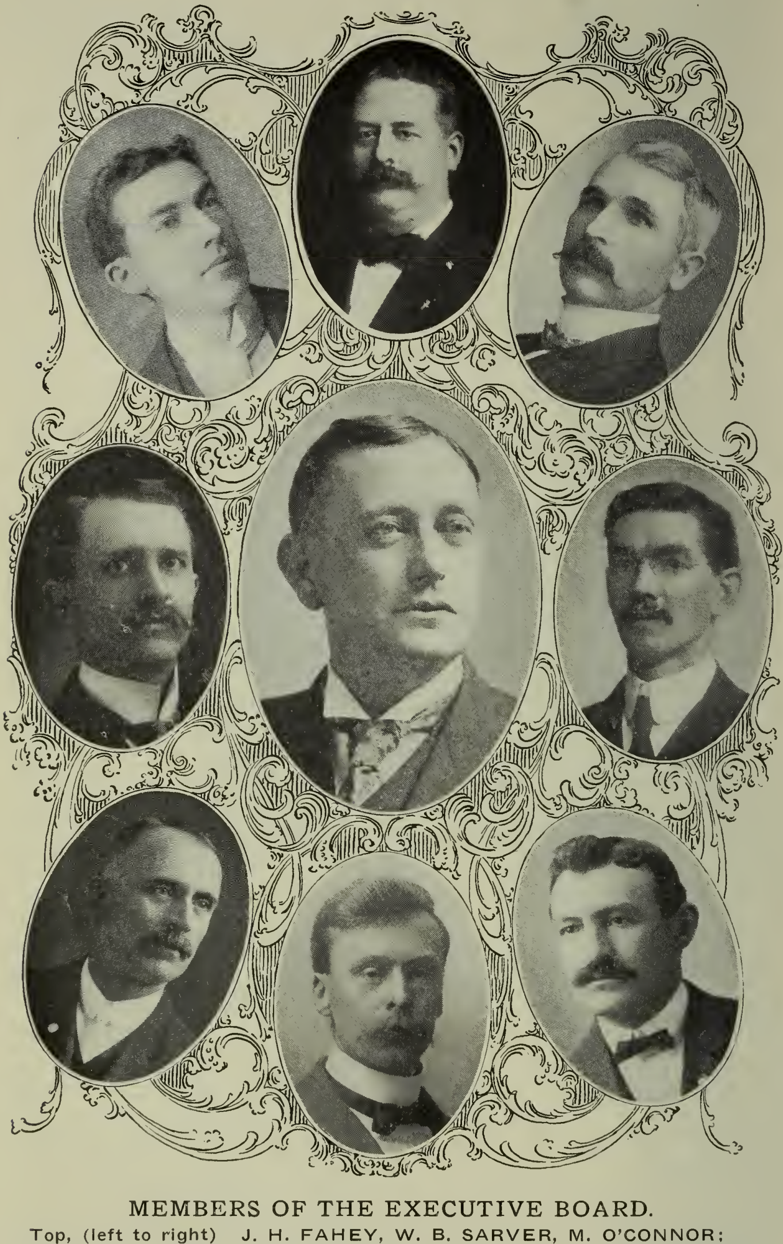
The President: As a Congressman stated after the subject had been exhausted, "There is nothing left for me to say, but 'Amen.'" I say "Amen" to all that has been said. We have certainly received a hearty welcome by the people of Louisville. The gates of this great city have been thrown open to us by its Mayor, and it is a great honor to be invited to enjoy the hospitality of a people who are known throughout the land from coast to coast for their kindness. That this hospitality still remains among the Kentuckians has certainly been proven to you this morning. It is evident to us all that these people are whole-hearted and whole-souled. (Applause.) Mr. Curtiss, Mr. May and especially Mr. Brown, I sincerely thank you on behalf of our association for the great interest that you have taken in our work. We are indebted to you; our success largely depends on the welcome extended to us. It is always a great encouragement to us to have gentlemen of experience address us at our meetings. I want to extend to you an invitation to be free to come into our sessions at any time during the week. We will be very much pleased to have you attend as many of them as you please.

Ladies, it is always an encouragement to us to see you present in such large numbers. It spurs us on to higher deeds, it encourages us in all our undertakings. I hope you will enjoy your sojourn in the city of Louisville, that each and every one will have a pleasant time and carry away fond memories of your visit here. I thank you for your attention. (Applause.)

The President: I have been requested to announce by the Entertainment Committee that the ladies will assemble in the Red Parlor at 3 p. m. to participate in a euchre party. Several prizes will be awarded and refreshments and music will be furnished.

Gentlemen, we are requested to assemble promptly at 1 o'clock in the lobby, as cars will be waiting to take us out to the L. & N. shops. I am also requested to announce that there will be a reception for all of us in this room tonight at 8 o'clock.

We will now proceed with the regular order of business. As the different subjects come up in their regular routine way before the convention, I want each and every one of you to take an interest in them. We have gathered here for the purpose of



MEMBERS OF THE EXECUTIVE BOARD.
Top, (left to right) J. H. FAHEY, W. B. SARVER, M. O'CONNOR;
Center, H. J. RAPS, J. T. GOODWIN, Chairman, W. H. LAUGHRIDGE;
Bottom, C. J. MURRAY, JAMES CROMBIE, J. A. DOARNBERGER,

making this meeting a successful one, to pass upon recommendations, upon standards and to exchange ideas with each other. So as these come up, do not be backward about expressing your opinions. We don't want a silver tongued speech, we want your ideas. That is what we are here for. Please be as brief as possible in your remarks.

We have been severely criticized, and perhaps the criticism was due us last year, for getting our proceedings out so late, but it was unavoidaole. We were greatly hampered by the condition of our treasury. A large number of members were delinquent with their dues last year, and this of course was a great hindrance. There were obstacles that seemed insurmountable at times, but thanks to the untiring energy of Mr. Goodwin, Chairman of the Executive Board, and Mr. Vought, the Secretary, it was finally possible to produce the proceedings. They worked night and day and finally we were assured of sufficient funds to pay for the printing. You understand that the business world was in no mood to advertise last year, and to approach them on that subject meant a cold refusal. It was a pretty hard matter to get enough advertisements to do this work. All who are here are kindly urged to pay their dues for the coming year.

The first thing in order will be the report from the Secretary.

Mr. Goodwin: I was not aware that we were to have any program today except the exercises just held. As we are going to the Louisville & Nashville shops this afternoon and have only a little time for luncheon, I think it would be well to pass our reports until tomorrow morning.

Mr. Wehling: I move we adjourn.

Mr. Laughridge: I second the motion.

The question was put and the motion carried unanimously.

Adjourned until Wednesday morning, April 28th, 1909, at 9:30 o'clock.

SECOND DAY'S SESSION.

The convention was called to order by the President at 9:30 a. m.

The President: The first order of business this morning will be the report from our Secretary, Mr. Harry D. Vought.

The Secretary: Mr. President and gentlemen of the convention: The Secretary's formal report, with the exception of the financial statement, you have all received, I presume, because it was sent out in printed form. It requires one change. Ten new members were elected during the year instead of seven. Since the convention opened we have received 20 or 25 additional applications. (Applause.)

The total receipts of the Secretary's office were $538.05. The total disbursements over $591.72, leaving a balance of $53.67 in favor of the Secretary.

In this connection, Mr. President, I beg to advise the members of the association, that at the time of the opening of the convention, more than 200 members were in arrears for dues for the past year, which were due and payable at the opening of the convention last year. Bills were sent to the members but they did not respond. Some of them who are at this convention have paid their dues for the past year and for this year. This slightly reduces the number, but we have practically 200 members in arrears. This explanation is made for the benefit of the members of the Association who wonder why we do not have more money in the treasury. The fault is directly with the members of the Association. If all will pay up, we will be in very good financial shape. It is only fair to say, Mr. President, in connection with the statement you made yesterday about the very great embarassment and difficulty we had in getting out the proceedings of the last annual convention, that the President, the Chairman of the Executive Board and myself were reluctant to incur the expense of printing those proceedings until we knew definitely that we could pay for it. I am very glad to say that finally by great exertion we accumulated the necessary funds so that the Association incurred no expense whatever. Another cause of delay was that some of our members were very slow in returning the transcript of the stenographer's notes of their remarks during the convention. It is my understanding that in the days of the old Associations, the members had very little opportunity to revise their statements before the convention and put them in the shape they would like to have them, so that sending their manuscripts last year was an innovation. Several did not return them for over two months, and in one or two instances these were held for three months. Now please bear in mind that the more prompt you are in returning the transcripts, the sooner the record will be made up. It then has to go to the Chairman of the Executive Board for his examination and revision before the Secretary can place them in the hands of the printers. If you will keep these matters in mind you may feel assured that your work will be handled expeditiously. (Applause.)

ANNUAL REPORT OF THE SECRETARY.

To the Officers and Members of the International Master Boiler Makers' Association:

The explanation for whatever measure of brevity may be noticeable in the second annual report of your Secretary is found in the fact that the past year has been so remarkably uneventful in the affairs of the organization that the recital of whatever has been done, or that has required attention, does not warrant extendered trespass upon time allotted to the convention and which can be used to better purpose.

As you have already learned from the published proceedings of the Detroit convention, the Executive Board organized immediately after the close of the final session, set the necssary machinery in motion for the production of conditions intended to make this meeting more memorable than its predecessors, increase the value of work performed and effect results designed to establish this Association upon a policy of such enlarged breadth as to leave no question as to its perpetuity and usefulness.

In consideration of the length of time intervening since we were last privileged to greet one another in convention and engage in an interchange of thought and conclusion, the officers and the members of the Executive Board, in the discharge of their important obligations, have had to contend with embarrassments and disadvantages beyond the ken of the general membership. The period has been one of trying moment in many ways of which practically little could be known by the members, and which in some respects has possibly taxed their patience. It was a time of extreme business depression, from which we are only now but very gradually emerging. With limited sources of revenue available, it was for a considerable time a serious and perplexing problem as to whether it would be possible to meet expectation with a publication of the proceedings of the Detroit convention in the manner desired and contemplated. In its final accomplishment there is cause for congratulation. All should feel a sense of satisfaction in the fact that it was possible to give to the business and mechanical world a volume evidencing how faithfully you labored to produce something of real value along the lines that were so earnestly advocated by those who knew and thoroughly appreciated the need of convincing proof that this Association is properly performing its mission. Even when facing aspects fraught with discouragement, those charged with the responsibility of carrying forward the work entrusted to them never wavered, and that they were able to sweep aside every obstacle and achieve success testifies to their zeal, devotion and courageously unremitting effort. It serves to emphasize the further fact that there has been singleness of purpose of the highest order, and a unity of action which means much for the future of the Association in the example afforded for the emulation of those who must hereafter pull the laboring oar.

Unfortunately, we cannot boast with pride of increasing numbers. Possibly this may be attributed to members not awakening to their individual responsibility and opportunity. If there is to be that accession of membership so essential to future growth and progress, it can be effected only by every member of the Association realizing that he has a personal obligation resting upon him, and that only in properly meeting it can the object in view be attained. Since we met resignation has removed one, so that the record is not much greater than it was 12 months ago. If from the total number of 372 now upon the books we deduct 27 that are liable to suspension, the result will be a distinct and significant loss upon which all will need to ponder. The lesson is obvious, and only by heeding what it teaches and getting to work with a strong determination for improvement, will it be possible to reach the goal you set up when the consolidation was effected at Cleveland. Eleven members have paid dues for 1910, and 118 are delinquent for the past year.

The Secretary wishes to repeat with added emphasis what was said in his last annual report with regard to members giving prompt notice of changes in business connection, location and address. It will greatly facilitate the work which has to be done during the year and prevent disappointment and vexation because Association literature when properly mailed is not received.

The method of registry adopted last year has been continued for this occasion. It has been forcibly brought to the attention of those who are here, in the official programme, and those who fail to heed its advantage will have no one to blame but themselves if they fail to reap the benefit it is designed to confer.

With renewed assurances of appreciation for continued courtesy and indulgence, and best wishes for still brighter days in the history of the Association,

Respectfully submitted,

HARRY D. VOUGHT,
Secretary.

FINANCIAL STATEMENT.

RECEIPTS.

Balance from 1907-8		$67.05
Dues	$362.00	
Initiation fees	84.00	
The "Boiler Maker" magazine	25.00	$471.00
Total		$538.05

DISBURSEMENTS.

Remitted to Treasurer June 23rd, 1908, with expense statement of $89.89 included		$331.10
Paid a percentage of 75 cents per member of 177, $2 payments	$135.75	
Paid E. C. Bruen for printing committee reports 1908 convention	66.61	
Paid postage on convention Proceedings mailed to members	23.00	
Paid M. E. Dorrler, typewriting 6 copies report of Committee on "Rules and Formulas" by order of the Executive Board	15.00	
Paid postage on committee reports and programme to members	7.02	
Paid miscellaneous postage	7.48	
Paid postage and express charges to Mr. Fahey	1.10	
Paid filing folders	3.20	
Paid postage	.22	
Paid audit book	.40	
Paid express charges on cut of Chambersburg Engineering Company	.25	
Paid express package to Mr. Goodwin (Proceedings)	.35	
Paid stationery to Mr. Conrath (Postage)	.25	
Paid express from Mr. Goodwin (Proceedings)	.35	
Paid Proceedings to Mr. Goodwin (Adams Express)	.50	
Paid express package to Mr. Goodwin	.55	
Paid express on proceedings from Richmond	.70	
Paid wire from Mr. Goodwin	.40	
Paid express from Mr. Goodwin	.25	
Wire Mr. Best April 13th	.50	
Wire Mr. Best April 15th	.50	
Bank Exchange	.50	
Wire from Mr. Clarence E. Walker, Louisville	.50	$265.38
Total		$596.48

RECAPITULATION.

Total receipts	$538.05
Disbursements	596.48
Balance due the Secretary	58.43

Respectfully submitted,
HARRY D. VOUGHT,
Secretary.

The President: Gentlemen, you have heard the report of our Secretary. I believe that next in order is the report of the Treasurer. Mr. Gray, will you kindly make your report.

Treasurer Gray: My report dates from our last convention to the 24th of this month, and does not include any money or any of the business that has been transacted since the convention assembled. I have it in detail, but will give simply a summary. We had in the treasury at the close of the past year and before the Detroit convention, $102.76. On June 23, 1908, I received $241.21 from our Secretary, and bills that he had already paid out of money in his possession, amounting to $89.89, making the total receipts $331.10, and the total amount in the treasury $433.86. During the same period expenses of $263.98 have been paid, leaving a balance in the treasury April 24, 1909, of $169.88, in addition to what the Secretary has now.

ANNUAL REPORT OF THE TREASURER.

April 27th, 1909.

To the Officers and Members of the International Boiler Makers' Association:

The undersigned begs leave to report the following as the total receipts and expenditures for 1908-09, with an accompanying schedule showing these in detail and the bills paid:

RECEIPTS.

Balance on hand May 23, 1908		$102.76
Cash from the Secretary	$241.21	
Bills paid and percentage of Membership fees retained by Secretary	89.89	331.10
Total		$433.86

EXPENDITURES.

Sunday approved bills, miscellaneous expenses	$263.98	
Balance in treasury	169.88	$433.86

Respectfully submitted,
F. GRAY,
Treasurer.

The Secretary: So far during the convention we have received about $250.

Mr. Laughridge: I move the report of the Secretary and Treasurer be received and referred to the Auditing Committee when appointed.

Mr. Brown: I second the motion.

The question was put and the motion carried.

APPOINTMENT OF SPECIAL COMMITTEES.

The President announced the following committees: Audit:—W. H. Laughbridge, Chairman; C. G. Wehling and John Troy.

Resolutions:—J. H. Smythe, Chairman; John McKeown, Sr., and P. F. Flavin.

Next place of meeting:—C. E. Elkins, Chairman, J. J. Mansfield, Thomas W. Lowe and W. G. Stallings.

Constitution and By-laws:—W. H. Laughridge, Charles P. Patrick and A. N. Lucas.

Subjects for next convention:—C. L. Hempel, Chairman; Thomas Lewis, C. L. Wilson, Thomas J. Reddy, George Wagstaff, Joseph McAllister and A. L. Bowman.

The President: These committees will get together during the convention and make their reports as early as possible. Next on the program is miscellaneous business.

The Secretary: Under the head of Miscellaneous Business we have the following applications for membership:

John T. Bond, General Boiler Inspector, N. Y. N. H. & H. R. R. New Haven, Conn.
William B. Boom, M. B. M., The Bay City Boiler Co., Bay City, West Side R. F. D.. No. 4, Mich.
Charles W. Buffington, B. M. F., B. & O. R. R., Holloway, O.
M. F. Courtney, G. B. I., Great Northern Railway, St. Paul, Minn.
J A. Coxedge, B. F., M. P. R. R., Hoisington, Kan.
W. A. Cusick, F. B. M. Hicks Leo. & Car Works, Chicago Heights, Ill.
James F. Dalton, 1002 E. Market Street, Louisville, Ky.
A. M. Dustin, F. B. M., M. P. R. R., Sedalia, Mo.
John T. Finucane, F. B. Dept., S. P. R. R., 2110 Providence Street, Houston, Tex.
Frank A. Griffin, B. M. F., S. O. R. R., Spencer, N. C.
James G. Gunn, F. B. M., I. C. R. R., 1527 Dumesnil St., Louisville, Ky.
J. N. Heltzel, A. F. B., Erie Railroad, 275 Arch St., Meadville, Pa.
J. C. Keefe, F. B. M., T. & O., C. R. R., Bucyrus, O.
John T. Kelly, F. B. M., International of Mexico, I. M. Hotel, Escacion, Monclova, Coah., Mexico.
M. Manley, F. B. M., L. & N. R. R., Boyles Shops, Birmingham, Ala.
M. H. Newgirg, B. M. F., C. & N. W. R. R., Belle Plaine, Ia.
Henry S. Nixon, Salesman, Chambersburg Engineering Co., Chambering, Pa.
B. H. Nudyke, Foreman, Henry Vogt Machine Co., 1413 Sixth Street, Louisville, Ky.
Carl J. Peterson, Foreman & Inspector (Nights) C. B. & Q. R. R., 3043 Race Street, Denver, Colo.
C. T. Petzinger, Foreman, Boiler Dept., Central of Georgia Railroad, 758 Second Street, Macon, Ga.
George M. Rearick, F. B. M., B. & S. R. R., Galeton, Pa.
James Ryan, F. B. M., L. & N. R. R., 211 Howell Street, Covington, Ky.
A W. Schaeffer, B. M. F., St. L. M. & S. R. R., Van Buren, Ark.
Fred M. Smith, F. B. M., Southern Railroad, 1009 S. Race St., Prinston, Ind.
John B. Tate, F. B. M., P. R. R., 200 Logan Ave., Altoona, Pa.
E. H. Tredinnick, F. B. M., Erie Railroad, 36 Glass St., Port Jervis, N. Y.
Alexander Tulley, A. F. B. M., Erie Railroad, 1627 Water St., Meadville, Pa.
Stephen E. Westover, G. B. M. F., C. & W. R. R., Box 205 Pueblo, Colo.
F. N. Witting, F. B. M., D. S. S. & A. R. R., 920 Lee St., Marquette, Mich.
L. C. Woodington, F. B. M., Southern Railroad, 111 E. Third Avenue, Knoxville, Tenn.
C. F. Young, B. I., L. S. & M. S. R. R., Elkhart, Ind.

The Secretary: There are two more applications, Mr. Charles E. Fiesel, Gang Foreman, of the Louisville & Nashville, Louisville, Kentucky, and Mr. George W. Doran of the Lake Shore, Cleveland, Ohio. There are no further applications.

These applications have been approved by the Executive Board and are now before the convention for final vote.

Mr. Brown: Mr. President, I move that these applicants be received, in accordance with our Constitution By-laws, as members of the International Master Boiler Makers' Association.

Mr. Flavin: I second the motion.

The Secretary: Applications have also been received from S. L. Brakebill of the Louisville & Nashville, Etowah, Tenn., and J. P. Tate of the Pennsylvania, Altoona, which will make the list complete up to the present time.

The President: The motion is that all applications for membership as you have heard them read, be accepted as members in the International Master Boiler Makers' Association. The number is 29.

A vote was taken and the motion carried unanimously.

The Secretary: We have a large number of invitations from various localities; Atlantic City, Omaha, Niagara Falls, Buffalo, San Francisco, Cincinnati, and Denver, indorsed by governors, commercial bodies and others, for the next Convention. The Secretary suggests that these be referred to Committee on Next Place of Meeting without taking up the time of the convention by reading them.

The President: This committee will kindly call for these papers.

REPORT OF THE COMMITTEE ON RULES AND FORMULAE.

The President: Charles P. Patrick, Chairman of the Committee on Rules and Formulae, is your report ready, and are the other members of your committee present?

Mr. Patrick: Only one of them.

The President: Have you any suggestion to make relative to your report?

Mr. Patrick: I suggest a committee of five men who are familiar with the technical construcion of boilers, etc., be appointed to go over the matter contained in our report and reccomend such as may be useful to the members of the Association. The report was so large that we could not publish it and get it into the members' hands within 30 days before the convention as we contemplated. I would suggest that this committee go over these rules and recommendations pertaining to good practice and cut out and add to as they may see fit and make their recommendations to this body, and that this body be governed chiefly by what the committee instructs them to do. I think there are only two subjects that will require discussion—the staying of flat surfaces with screw stay-bolts and the shearing strength of rivets. This is about all that will call for argument.

The President: This committee has spent a good many hours on this report. They have sacrificed both labor and money for the benefit of this Association. This committee has in fact put in pretty near every Sunday in the past six or eight months, and has produced a piece of work that is a credit to any organization. Let us not look at this report as an insignificant thing. I have perused it whenever I had time, just here and there, and I want to tell you, gentlemen, it is an able piece of work and a credit to the committee and the Association. Some of it will be challenged and perhaps I would challenge; but the Benefit Committee have always stayed on the safe side. The test of the shearing strength of rivets does not correspond with past tests made by this Association. For three or four successive years we had committees make such tests and produce the pieces of rivets at the Convention. Not one of them was as low as the figures in this report, and with all due respect to the Committee, that feature of the report, perhaps, should be changed. But our time is limited and we have an enormous amount of business to be done. We are here for a purpose and to perform a duty which we owe to ourselves, our employers, and, in fact, the public at large. Therefore, in my judgment a committee of five or six conservative members should check up the report and make recommendations. If the members see fit to adopt it as it is, well and good. Let us put it into book form if possible. If you afterwards find something in it that is not absolutely correct, we can change it next year.

Mr. Flavin: I move that the Committee be increased according to your judgment and that the little books be published and distributed along the line of your talk.

Mr. Lucas: I second the motion that these recommendations be adopted and the formulae be published in book form.
mendations are absolutely the property of this Association. If

The President: There is just this about it. The recom-
outsiders wish to get these rules and formulae, they ought to pay for them. Perhaps it might be a good idea to assess the members 50 or 75 cents for a copy. That is for you, gentlemen, to decide and not me. Are there any further remarks?

Mr. Brown: Mr. President, do I understand then that there has been a committee pending drawing up these rules and formulae and now have them in manuscript? Do I also understand that the report of this Committee is to be accepted or rejected? Are we to accept this copy as it is without knowing what it is?

The President: The motion is to appoint a committee of five conservative members to check up this report.

Mr. Brown: Now I understand.

The President: And if the Committee then sees fit to recommend them for adoption, they will do so later on.

Mr. Brown: That is all right.

The President: The motion before the house is that a committee of five be appointed, incluling the Chairman of the Committee on Rules and Formulae and the other member that is present, to check up the rules and formulae, and at the close of the Convention to make their recommendations as to adoption, rejection or to carry over the report to next year.

A vote being taken, the motion was carried unanimously.

The President: The Committee will consist of Mr. Patrick, Mr. Murray, Mr. Wratten, Mr. Rapps from Waterloo, Iowa, and Mr. Doainberger.

REPORT OF COMMITTEE ON STANDARDIZING SHOP TOOLS AND EQUIPMENT.

The President: The next committee to report will be the Committee on Standardizing of Shop Tools and Equipment. Mr. T. C. Best is Chairman. Mr. Best, will you kindly make your report.

Mr. Best: Mr. Chairman, allow me to correct you, Mr. Fahey is Chairman.

The President: He is not present and I was instructed by letter to have Mr. Best act as Chairman of the Committee.

Mr. Best: This report is quite long and will take considerable time to read. If you wish to hear it I will request the Secretary to read it. I did not have a program this morning and was not aware that this subject was to come up at this time. Therefore I left all of the correspondence pertaining to the subject in my room. The committee has spent at least nine or ten months, almost every night and Sunday, compiling the information and preparing the report on standard boiler shop tools, machinery and equipment. The majority of the time, however, was consumed in compiling information on standard punches, dies and the couplings for power tools. In the beginning we did not realize the proposition we had on hand. We found that the manufacturers of some of the so-called standards that were on the market did not have the discussions when detailed dimensions were requested. So it resulted in our being obliged to make new drawings and new details in many cases, which consumer a great deal of time. We have not accepted any of the standards which we recommend to the Association and feel that we have not been hasty in making our recommendation. When I learned that our treasury was low, and on this account the report might suffer delay, I immediately took the matter up with our house, through our Chairman, J. H. Fahey, who, in a communication, asked if they would be kind enough to publish this report for the committee, which they did. He also told them that if they would publish this report, it would be highly appreciated by the members of the Association. We have not only gone into the matter of punches, dies and couplings, but also drift pins, pneumatic tools, marking punches, etc., and I will leave it to the pleasure of the convention as to whether or not they will have the report read, or what disposition they wish to make of it.

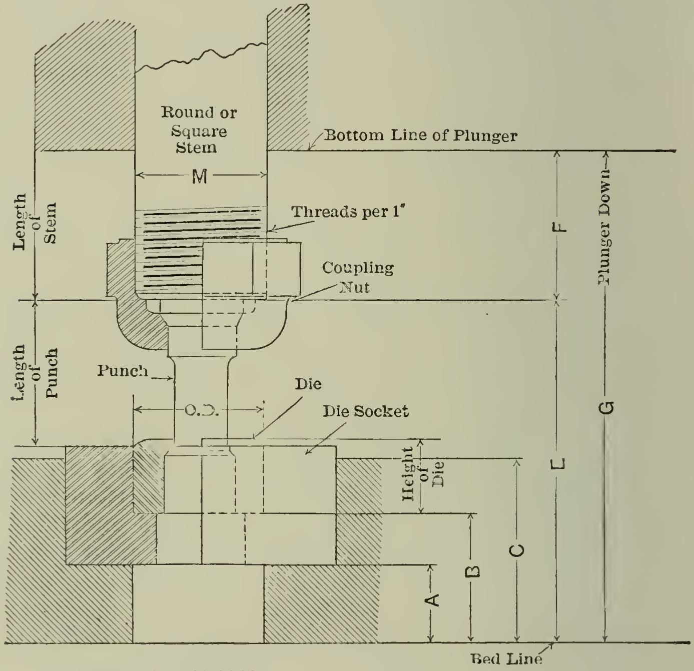
To the Officers and Members of the International Master Boiler Makers' Association.

Your Committee on Standard Tools, Machinery and Equipment beg leave to report:

The work of compiling the dimensions of standard punches, dies and couplings has consumed several months' time and has required a great deal of correspondence, far more than was at first anticipated; but we feel that we have already been rewarded for our labors by the generous and earnest, impartial co-operation of the punch, die and coupling manufacturers, to whom we are indebted for much information. They are deserving of much credit for their kind and prompt assistance to your yourCommittee, for without this unanimous and undivided support your Committee would have labored under great difficulties. We have had numerous encouraging letters from nearly all interested, but particularly from the punch and shear manufacturers themselves, expressing a desire to see one recognized standard adopted, and to show the necessity of such a standard we might cite an example. For instance, one prominent punch and shear manufacturer carries in stock, ready for immediate delivery, every known standard punch, die and coupling, and as a result of their last inventory, a few months ago, had in stock 307,000 punches, whereas if one standard is adopted probably 50,000 punches would constitute a fair stock to be carried by any one of them. This same concern is perhaps the first on our list to make the broad statement that the adoption of a standard by this Association would be a good thing and one of the best moves that the Association has ever made.

We have also received many letters from those directly interested in the work, and it is evident, judging from the tenor of the same, that whichever standard the Association sees fit to adopt, we will still have the same co-operation of the manufacturers which has prevailed throughout the entire period of our labors; also, that whichever standard may be adopted by this body will be acceptable to the punch and shear manufacturers.

PROPOSED INTERNATIONAL MASTER BOILER MAKERS' STANDARD CLASS "A" PUNCHES.



STYLE "A" PUNCH.

A = bed line to die socket seat.
B = bed line to die seat.
C = bed line to top of die block.
E = bed line to bottom of punch stem.
F = bottom of stem to bottom of plunger.
G = bed line to bottom of plunger.

The price of a new punch stock is but a trifle and should not be considered at all, when the owner realizes that, if his machine is thus equipped, he can purchase a punch, die or coupling from the nearest house handling this line with absolute certainty of a perfect fit, and that his order will be filled immediately, to say nothing of the time and trouble saved in ordering by number instead of having to send a sketch with the order.

Your Committee believes in a standard and earnestly recommends the adoption of same.

Your Committee, after deliberating over the matter of standard punches, dies and couplings for several months, feels that we have not been hasty in making a selection for your consideration.

Knowing that we have been dealing with a delicate subject, and that poor judgment on our part would subject the Association to much criticism; realizing that our recommendations must be backed up by a reason for our selection, and having looked carefully into the situation from every viewpoint, mechanical and otherwise, each member of your Committee has taken keen interest and given the subject deep study, and we therefore feel ourselves competent to pass judgment upon the commodities in question, and without fear of criticism from members of the Association or broad-minded men interested in the subject, we submit herewith, for your consideration, standard punches, dies, couplings, drift pins, pneumatic riveting sets, as well as chipping and calking and beading tools, all of which have had due consideration.

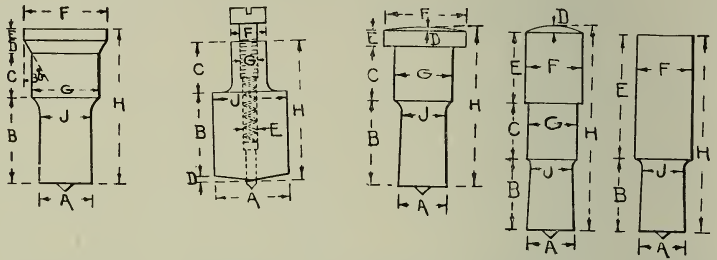
It gives us great pleasure to say that our recommendations are made impartially and that we have been prompted in arriving at a conclusion only by our best judgment.

It has also been the ambition and desire of the Committee, in the selection of a standard, to achieve a degree of perfection beyond criticism. With this object in view we have sifted the subject to the bottom, and for the information of the members we reproduce each of the approved tracings, which show in detail all standard dimensions of punches, dies and couplings, representing in a measure a small portion of the work done, and showing the thorough manner in which your Committee has treated the subject. The fact that we are in possession of all of the detailed information pertaining to the subject should give the officers and members some idea as to how we arrived at a conclusion.

First, we will take up the matter of punches and will say that we have in our possession a table showing the dimensions of all standards introduced and made by the various manufacturers.

Before delving too deeply into the subject, we desire to make known the fact that we have not accepted any of the standards now in use, but have decided upon a new system and a new standard. We now present this system and detailed dimensions of punches, dies and couplings for consideration, for the following reasons:

First—Because it is the only system which, with one stem and one coupling, with the aid of sleeves, will render it possible to punch almost all holes required in a boiler or plate shop without changing the stem. With this system, holes from ⅛ inch diameter to 1 15-16 inches diameter can be punched.



Style A. Power Punch. Under 2⅝″.

Style B. Power Punch. 2⅝″ and over.

Style C. Cast Screw Punch.

Style D. Forged Screw Punch

Style E. Straight Shank Punch.

ALL STYLES OF PUNCHES.

Second—The sleeve renders it possible to make small punches out of the smaller-sized steel.

Third—We believe that punches 2⅝ inches in diameter and larger should not be made for use with a coupling nut, and are of the opinion that when this size is reached the nut should be entirely dispensed with, not only saving the cost of a nut, but by using style "B" punch it can be made out of much smaller size steel, besides the fact that it takes up less room and holes can be punched much closer to the flange.

Fourth—We believe that when a punch is broken it should be scrapped and no attempt should be made to use it up by a series of steel blocks and extra long couplings. The most complete system in our judgment is the one having the least parts and of the best mechanical construction; hence we produce herewith not only detailed drawing of punches which we recommend, but also a table giving dimensions, which we hope will be found useful to those interested in punches.

STANDARD STYLE "A" POWER PUNCH DIMENSIONS AS MADE BY THE VARICUS PUNCH MANUFACTURERS; ALSO RECOMMENDATIONS OF THE COMMITTEE.

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	0	5/32 to 13/32	5/8	9/32	3/16	5/32	19/32	13/32	1 1/4
	WICKES BROS.	0	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	0	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	0	"	"	"	"	"	"	"	"
	PRATT & WHITNEY CO.	2	1/8 to 3/8	13/16	9/32	3/32	3/32	17/32	13/32	1 9/32
	GEO. F. MARCHANT	2	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	2	"	"	"	"	"	"	"	"
	KLING BROS.	2	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	2	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	2	"	25/32	"	"	"	"	"	1 1/4
	AMERICAN DIE & TOOL CO.	2	"	13/16	"	"	"	"	"	1 9/32
	CLEVELAND P. & S. WKS. CO.	6	1/8 to 9/16	29/32	7/8	5/32	3/16	3/4	9/16	2 1/8
	WILLIAMS WHITE & CO.	B	1/8 to 7/16	3/4	3/32	5/32	1/8	19/32	27/64	1 5/16
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	1	1/8 to 7/16	3/4	1 1/32	5/32	3/16	3/4	9/16	2 1/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	1	9/32 to 9/16	13/16	3/8	5/32	5/32	3/4	9/16	1 1/2
	WICKES BROS.	1	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	1	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	1	"	"	"	"	"	"	"	"
	PRATT & WHITNEY CO.	3	1/8 to 9/16	31/32	9/32	7/64	7/64	23/32	19/32	1 15/32
	GEO. F. MARCHANT	3	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	3	"	"	"	"	"	"	"	"
	KLING BROS.	3	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	3	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	3	1/4 to 9/16	1	"	"	"	"	"	1 1/2
	AMERICAN DIE & TOOL CO.	3	1/8 to 9/16	31/32	"	"	"	"	"	1 15/32
	CLEVELAND P. & S. WKS. CO.	11	19/32 to 3/4	1 3/32	5/8	7/32	3/16	1	3/4	2 1/8
	WILLIAMS WHITE & CO.	C	1/4 to 5/8	15/16	3/8	1/8	1/8	23/32	39/64	1 9/16
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	2	15/32 to 11/16	1	29/32	7/32	3/16	1	3/4	2 1/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	2	9/16 to 13/16	27/32	5/16	3/16	5/32	63/64	13/16	1 1/2
	WICKES BROS.	2	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	2	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	2	"	1	"	"	"	"	"	
	PRATT & WHITNEY CO.	4	1/4 to 3/4	7/8	3/8	1/8	1/8	29/32	25/32	"
	GEO. F. MARCHANT	4	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	4	"	"	"	"	"	"	"	"
	KLING BROS.	4	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	4	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	4	7/16 to 3/4	"	"	"	"	"	"	"
	AMERICAN DIE & TOOL CO.	4	1/4 to 3/4	"	"	"	"	"	"	"
	CLEVELAND P. & S. WKS. CO.	16	25/32 to 1 1/16	1 11/32	3/8	5/32	1/4	1 1/4	1 1/16	2 1/8
	WILLIAMS WHITE & CO.	D	11/16 to 13/16	1 3/16	5/16	1/4	1/8	1 1/16	51/64	1 7/8
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	3	23/32 to 1 1/16	1 3/16	19/32	5/32	3/16	1 1/4	1 1/16	2 1/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	3	11/16 to 1 1/16	1 1/8	3/8	3/16	3/16	1 1/4	1 1/16	1 7/8
	WICKES BROS.	3	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	3	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	3	"		"	"	"	"	"	2
	PRATT & WHITNEY CO.	5	3/8 to 1	1 1/4	7/16	1/8	1/8	1 5/32	1 1/32	1 15/16
	GEO. F. MARCHANT	5	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	5	"	"	"	"	"	"	"	"
	KLING BROS.	5	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	5	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	5	9/16 to 1	"	"	"	"	"	"	"
	AMERICAN DIE & TOOL CO.	5	3/8 to 1	"	"	"	"	"	"	"
	CLEVELAND P. & S. WKS. CO.	23	1 3/32 to 1 5/16	1 11/32	3/8	5/32	1/4	1 1/2	1 5/16	2 1/8
	WILLIAMS WHITE & CO.	E	7/8 to 1 1/16	1 1/2	11/32	1/4	5/32	1 5/16	1 1/32	2 1/4
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	4	1 3/32 to 1 5/16	1 3/8	13/32	5/32	3/16	1 1/2	1 5/16	2 1/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	4	13/16 to 1 5/16	1 7/16	7/16	3/16	3/16	1 35/64	1 5/16	2 1/4
	WICKES BROS.	4	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	4	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	4	"	1 1/2	"	"	"	"	"	"
	PRATT & WHITNEY CO.	6	1/2 to 1 3/16	1 17/32	17/32	5/32	5/32	1 3/8	1 7/32	2 3/8
	GEO. F. MARCHANT	6	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	6	"	"	"	"	"	"	"	"
	KLING BROS.	6	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	6	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	6	3/4 to 1 3/16	"	"	"	"	"	"	"
	AMERICAN DIE & TOOL CO.	6	1/2 to 1 3/16	"	"	"	"	"	"	"
	CLEVELAND P. & S. WKS. CO.	28	1 11/32 to 1 9/16	1 27/32	3/8	5/32	1/4	1 7/8	1 9/16	2 5/8
	WILLIAMS WHITE & CO.	F	1 1/8 to 1 1/4	1 5/8	27/64	19/64	5/32	1 9/16	1 7/32	2 1/2
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	5	1 1/16 to 1 9/16	1 7/8	1 1/32	9/32	3/16	1 7/8	1 9/16	3 3/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	5	1 1/16 to 1 9/16	1 21/32	1/2	9/32	5/16	1 33/64	1 9/16	2 5/8
	WICKES BROS.	5	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	5	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	5	"	"	"	"	"	"	"	"
	PRATT & WHITNEY CO.	7	3/4 to 1 1/2	1 25/32	17/32	3/16	3/16	1 11/16	1 17/32	2 11/16
	GEO. F. MARCHANT	7	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	7	"	"	"	"	"	"	"	"
	KLING BROS.	7	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	7	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	7	1 to 1 1/2	"	"	"	"	"	"	"
	AMERICAN DIE & TOOL CO.	7	3/4 to 1 1/2	"	"	"	"	"	"	"
	CLEVELAND P. & S. WKS. CO.	29	1 11/32 to 1 9/16	2 17/32	3/8	7/32	1/4	1 7/8	1 9/16	3 3/8
	WILLIAMS WHITE & CO.	G	1 5/16 to 1 9/16	2	7/16	1/4	3/16	1 13/16	1 17/32	2 7/8
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	6	1 5/8 to 2 1/16	2 3/16	26/32	7/32	3/16	2 5/16	2 1/16	3 3/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	6	1 5/16 to 1 13/16	1 25/32	9/16	5/16	7/32	2 11/64	1 13/16	2 7/8
	WICKES BROS.	6	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	6	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	6	1 5/16 to 1 13/16	"	"	"	"	"	"	"
	PRATT & WHITNEY CO.	8	1 to 1 3/4	2	9/16	1/4	3/16	2 1/16	1 25/32	3
	GEO. F. MARCHANT	8	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	8	"	"	"	"	"	"	"	"
	KLING BROS.	8	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	8	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	8	1 1/4 to 1 3/4	"	"	"	"	"	"	"
	AMERICAN DIE & TOOL CO.	8	1 to 1 3/4	"	"	"	"	"	"	"
	CLEVELAND P. & S. WKS. CO.	30	1 19/32 to 2 1/16	1 26/32	3/8	7/32	1/4	2 1/4	2 1/16	2 5/8
	WILLIAMS WHITE & CO.	H	1 5/8 to 1 3/4	3/16	29/64	19/64	3/16	2 1/16	1 23/32	3 1/8
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	7	2 1/8 to 2 9/16	2 1/2	43/64	15/64	9/16	2 13/16	2 9/16	3 3/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	7	1 5/16 to 2 1/16	25/32	1/2	3/8	7/32	2 31/64	2 1/16	2 7/8
	WICKES BROS.	7	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	7	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	7	1 9/16 to 2 1/16	1 25/32	"	"	"	"	"	"
	PRATT & WHITNEY CO.	9	1 1/2 to 2 1/4	2	9/16	7/32	7/32	2 9/16	2 9/32	3
	GEO. F. MARCHANT	9	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	9	"	"	"	"	"	"	"	"
	KLING BROS.	9	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	9	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	9	"	"	"	"	"	"	"	"
	AMERICAN DIE & TOOL CO.	9	"	"	"	"	"	"	"	"
	CLEVELAND P. & S. WKS. CO.	31	1 19/32 to 2 1/16	2 9/32	5/8	7/32	1/4	2 1/4	2 1/16	3 3/8
	WILLIAMS WHITE & CO.	I	1 13/16 to 2 1/4	3/8	43/64	21/64	1/4	2 9/16	2 7/32	3 5/8
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN	B	2 5/8 UP	3 1/4	1 1/8	1/4	3/8	1 3/8	1/8	5 3/8
	T. C. BEST	"	"	"	"	"	"	"	"	"
	Wm. SHOEMAKER	"	"	"	"	"	"	"	"	"
	O. C. VOSS	"	"	"	"	"	"	"	"	"
	J. H. SMYTHE	"	"	"	"	"	"	"	"	"

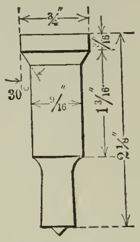
	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	8	1 9/16 to 2 9/16	1 31/32	1/2	5/16	7/32	2 53/64	2 9/16	3
	WICKES BROS.	8	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	8	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	8	1 13/16 to 2 9/16	"	"	"	"	"	"	"
	PRATT & WHITNEY CO.	10	2 to 2 5/8	2 1/32	9/16	9/32	1/4	2 31/32	2 21/32	3 1/8
	GEO. F. MARCHANT	10	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	10	"	"	"	"	"	"	"	"
	KLING BROS.	10	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	10	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	10	"	1 29/32	"	"	"	"	"	3
	AMERICAN DIE & TOOL CO.	10	"	1 1/32	"	"	"	"	"	3 1/8
	CLEVELAND P. & S. WKS. CO.	32	2 3/32 to 2 9/16	2 33/64	1/2	17/64	1/4	2 13/16	2 9/16	3 3/8
	WILLIAMS WHITE & CO.	J	2 3/8 to 2 5/8	2 5/8	45/64	27/64	1/4	3 1/16	2 19/32	4
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN									
	T. C. BEST									
	Wm. SHOEMAKER									
	O. C. VOSS									
	J. H. SMYTHE									

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	9	2 1/16 to 3 1/16	1 15/16	1/2	5/16	1/4	3 23/64	3 1/16	3
	WICKES BROS.	9	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	9	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	9	"	2	7/16	"	"	"	"	"
	PRATT & WHITNEY CO.	11	2 1/2 to 3 1/4	2 5/32	9/16	9/32	1/4	3 19/32	3 9/32	3 1/4
	GEO. F. MARCHANT	11	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	11	"	"	"	"	"	"	"	"
	KLING BROS.	11	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	11	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	11	"	"	"	"	"	"	"	3
	AMERICAN DIE & TOOL CO.	11	"	"	"	"	"	"	"	3 1/4
	CLEVELAND P. & S. WKS. CO.									
	WILLIAMS WHITE & CO.	K	2 3/4 to 3 1/4	2 3/4	27/32	13/32	1/4	3 11/16	3 7/32	4 1/4
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN									
	T. C. BEST									
	Wm. SHOEMAKER									
	O. C. VOSS									
	J. H. SMYTHE									

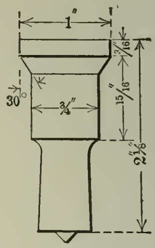
	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	10	2 9/16 to 3 9/16	2 7/16	1/2	5/16	1/4	3 55/64	3 9/16	3 1/2
	WICKES BROS.	10	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	10	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	10	"	"	"	"	"	"	"	"
	PRATT & WHITNEY CO.	12	3 1/4 to 4 1/8	2 13/32	9/16	11/32	5/16	4 1/2	4 1/8	3 5/8
	GEO. F. MARCHANT	12	"	"	"	"	"	"	"	"
	GEO. WHITING CO.	12	"	"	"	"	"	"	"	"
	KLING BROS.	12	"	"	"	"	"	"	"	"
	LOVEJOY TOOL WKS.	12	"	"	"	"	"	"	"	"
	HILLES & JONES CO.	12	"	"	"	"	"	"	"	3
	AMERICAN DIE & TOOL CO.	12	"	"	"	"	"	"	"	3 5/8
	CLEVELAND P. & S. WKS. CO.									
	WILLIAMS WHITE & CO.	L	3 1/2 to 4 1/8	3 1/8	27/32	17/32	1/4	4 11/16	4 3/32	4 3/4
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN									
	T. C. BEST									
	Wm. SHOEMAKER									
	O. C. VOSS									
	J. H. SMYTHE									

	NAME	NO	A	B	C	D	E	F	G	H
	I. P. RICHARDS	11	3 1/16 to 4 1/16	2 9/32	1/2	15/32	1/4	4 39/64	4 1/16	3 1/2
	WICKES BROS.	11	"	"	"	"	"	"	"	"
	CINCINNATI P. & S. CO.	11	"	"	"	"	"	"	"	"
	LONG & ALLSTATTER CO.	11	"	"	"	"	"	"	"	"
	PRATT & WHITNEY CO.									
	GEO. F. MARCHANT									
	GEO. WHITING CO.									
	KLING BROS.									
	LOVEJOY TOOL WKS.									
	HILLES & JONES CO.									
	AMERICAN DIE & TOOL CO.									
	CLEVELAND P. & S. WKS. CO.									
	WILLIAMS WHITE & CO.									
RECOMMENDED BY	J. H. FAHEY, CHAIRMAN									
	T. C. BEST									
	Wm. SHOEMAKER									
	O. C. VOSS									
	J. H. SMYTHE									

PROPOSED INTERNATIONAL MASTER BOILER MAKERS' STANDARD STYLE "A" PUNCHES AND SYSTEM OF SLEEVES.



Punch No. 1.
⅛ to 7/16.
For Coupling No. 1.



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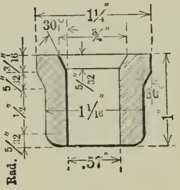
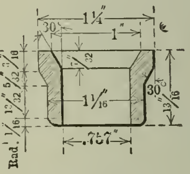
15/32 to 11/16.
For Coupling No. 2.



Sleeve No. 1.
For Punches.
⅛ to 7/16.



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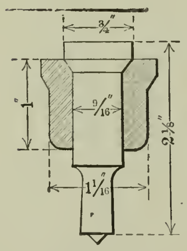
For Punches.
15/32 to 11/16.

THESE SLEEVES FIT NOS. 3 AND 3-S COUPLINGS.



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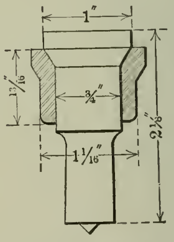
Sleeve No. 1.



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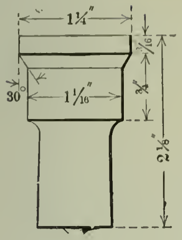
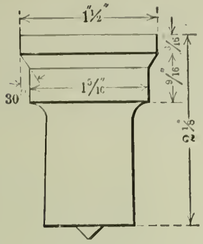
Sleeve No. 2.

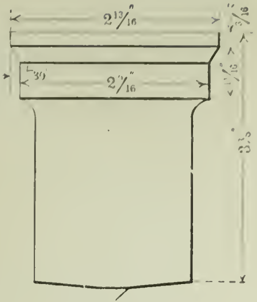
USED WITH NOS. 3 AND 3-S COUPLINGS.



Punch No. 3.
23/32 to 1 1/16.
Used with Nos. 3
and 3-S Couplings.

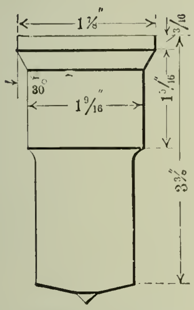


Punch No. 4.
1 3/32 to 1 5/16.
Used with No. 4
Coupling.

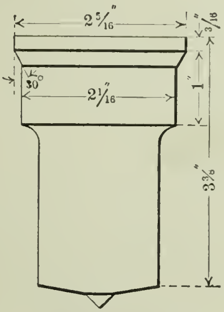


Punch No. 7.
2⅛ to 2 9/16.
Used with No. 7 Coupling.

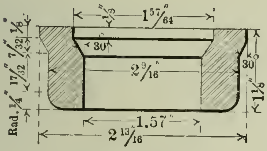
ABOVE PUNCHES USED WITHOUT SLEEVES.



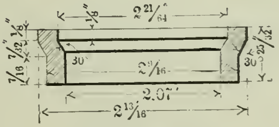
Punch No. 5.
1 1/16 to 1 9/16.
Used with Coupling No. 5 or
Coupling No. 7 with Sleeve
No. 5.



Punch No. 6.
1⅝ to 2 1/16.
Used in Coupling No. 6 or
Coupling No. 7 with
Sleeve No. 6.



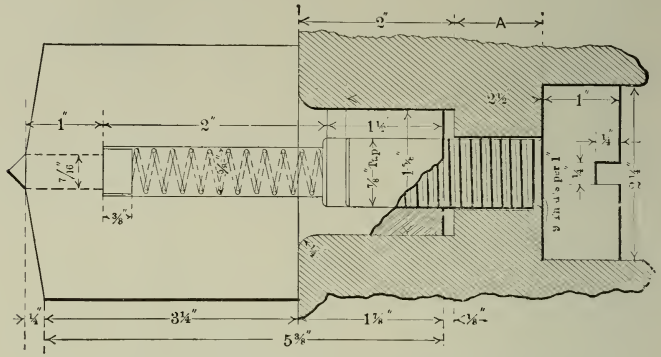
Sleeve No. 5.
For Punches.
1 1/16 to 1 9/16.
Used with No. 7 Coupling.



Sleeve No. 6.
For Punches.
1⅝ to 2 1/16.
Used with No. 7 Coupling.

Power punches 2 9-16 inches in diameter and smaller shall be known as style "A." All punches above this size shall be known as style "B." By this system of lettering our punches, we believe much confusion will be eliminated.

PROPOSED INTERNATIONAL MASTER BOILER MAKERS' STYLE "B" PUNCHES.



FOR ALL PUNCHES 2⅜ INCHES AND UP.

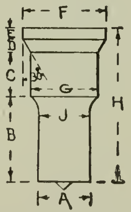
Dimensions given are standard for all sizes of punches regardless of the diameter or shape of the punching portion.

The spring used is 3 inches long, 19-32-inch outside diameter, and made of .047-inch diameter of wire.

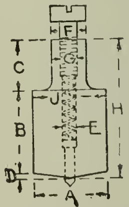
How to order punches by wire. Suppose we desired twenty-five 13-16-inch standard punches, we would order as follows:

Express twenty-five thirteen-sixteenths International Master Boiler Makers' "A" punches.

Style "B" punch, while shown as round, is well adapted to all irregular shapes, such as handholes,etc.



STYLE "A" PUNCH.



STYLE "B" PUNCH.

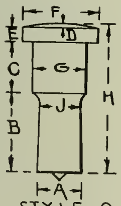
PROPOSED INTERNATIONAL STANDARD STYLE "A" AND "B" PUNCHES.

No.	A	B	C	D	E	F	G	H
1	⅛ to 7/16	¾	1 1/32	5/32	3/16	¾	9/16	2⅛
2	15/32 to 11/16	1	29/32	7/32	3/16	1	¾	2⅛
3	23/32 to 1 1/16	1 3/16	19/32	5/32	3/16	1¼	1 1/16	2⅛
4	1 3/32 to 1 5/16	1⅜	13/32	5/32	3/16	1½	1 5/16	2⅛
5	1 1/16 to 1 9/16	1⅞	1 1/32	9/32	9/16	1⅞	1 9/16	3⅜
6	1⅝ to 2 1/16	2 3/16	25/32	7/32	3/16	2 5/16	2 1/16	3⅜
7	2⅛ to 2 9/16	2½	29/64	15/64	3/16	2 13/16	2 9/16	3⅜
B	2⅝ & up	3¼	1⅞	¼	⅝	1⅝	⅞	5⅝

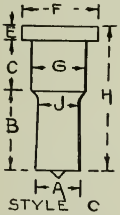
Style "A" punch is recommended for all sizes of punches up to and including 2 9-16" and style "B" for all sizes 2⅝" and larger.

SCREW PUNCHES.

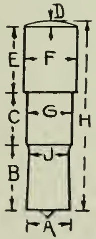
While the subject of standardizing screw punches may not interest all plate and structural workers, it should nevertheless receive the same general attention and consideration by this Association as power punches have, and it may be said that one standard for this class of tool is not only desirable but essential, and the adoption of same should be given immediate consideration.



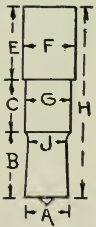
STYLE C
CAST SCREW PUNCH
BALL BEARING



STYLE C
CAST SCREW PUNCH
OLD STYLE



STYLE D
FORGED SCREW PUNCH
BALL BEARING.



STYLE D
FORGED SCREW PUNCH
OLD STYLE

We produce herewith the dimensions of the standard punches, as made by three different concerns who manufacture punches for screw frames. In a general way the sizes made by all manufacturers closely approximate each other, but are just enough different to cause annoyance.

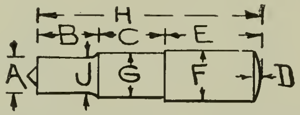
FORGED STEEL FRAME SCREW PUNCHES

NAME		NO	A	B	C	D	E	F	G	H	NO	A	B	C	D	E	F	G	H	NO	A	B	C	D	E	F	G	H
LOVEJOY TOOL WKS.		1	1/4 TO 11/16		11/16		1 1/8	47/64	11/16	2 1/2	2	1/4 TO 13/16		13/16		1 1/2	55/64	13/16	3 1/4	3	1/2 TO 15/16		7/8		1 1/2	1 3/32	15/16	3 9/16
AMERICAN DIE & TOOL CO.		1	"					3/4	11/16	2 1/2	2	"					7/8	13/16	3 1/4	3	"					1 3/32	15/16	3 5/8
CLEVELAND P & S WKS CO.		1	"	23/32	21/32		1 1/8	47/64	43/64	2 1/2	2	"	7/8	7/8		1 1/2	55/64	51/64	3 1/4	3	"	1 1/4	7/8		1 1/2	1 3/32	15/16	3 5/8
RECOMMENDED BY	J.H. FAHEY CHAIRMAN	1	1/8 TO 11/16	23/32	21/32	1/16	1 1/16	47/64	43/64	2 1/2	2	1/4 TO 13/16	7/8	7/8	1/16	1 7/16	55/64	51/64	3 1/4	3	1/2 TO 15/16	1 1/4	7/8	3/32	1 13/32	1 3/32	15/16	3 5/8
	T.C. BEST	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"
	O.C. VOSS	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"
	W. SHOEMAKER	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"
	J.H. SMYTHE	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"

CAST STEEL FRAME SCREW PUNCHES

NAME		NO	A	B	C	D	E	F	G	H	NO	A	B	C	D	E	F	G	H	NO	A	B	C	D	E	F	G	H
LOVEJOY TOOL WKS		1	1/8 TO 11/16		25/32		9/32	1 1/64	3/4	1 7/8	2	1/4 TO 13/16		3/4		19/64	1 7/64	7/8	2 1/16	3	3/8 TO 1		13/16		5/16	1 23/64	1 1/32	2 1/4
AMERICAN TOOL & DIE CO.		1	"		7/8		9/32	1	3/4	2	2	"		15/16		5/16	1 1/8	7/8	2 1/8	3	"		1		5/16	1 3/8	1	2 1/4
CLEVELAND P & S WKS CO		1	"	7/8	7/8		1/4	1	3/4	2	2	"	1	3/4		1/4	1 1/8	7/8	2	3	"	1 1/16	7/8		5/16	1 3/8	1	2 1/4
RECOMMENDED BY	J.H. FAHEY CHAIRMAN	1	1/8 TO 11/16	23/32	21/32	1/16	1 1/16	47/64	43/64	2 1/2	2	1/4 TO 13/16	7/8	7/8	1/16	1 7/16	55/64	51/64	3 1/4	3	1/2 TO 15/16	1 1/4	7/8	3/32	1 13/32	1 3/32	15/16	3 5/8
	T.C. BEST	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"
	O.C. VOSS	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"
	W. SHOEMAKER	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"
	J.H. SMYTHE	1	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	3	"	"	"	"	"	"	"	"

We are of the opinion that the old style, flat-top punch should be discarded and the more up-to-date style brought into practice. This style, for convenience, we have called ball-bearing, as it gives a ball-bearing effect when riding on a hardened steel block of the same shape placed within the screw, which, when in operation, would act like two balls riding on each other. Such a construction will permit the screw to revolve freely while the punch remains in one position. It has been found in practice to be a great improvement over the old style, flat head, as it requires considerably less power to punch a hole with this ball-bearing punch than it does with a flat-head punch, hence, in our search for information pertaining to screw punches, we have been unable to ascertain any good reason why there should be two different styles of punches for this class of tool, and after due consideration your committee has come to the conclusion that a revision of this subject is necessary and that one of the styles must be adopted and the other discarded.



PROPOSED SCREW PUNCHES

INTERNATIONAL STANDARD									
NO	A	B	C	D	E	F	G	H	J
1	1/8 TO 11/16	23/32	21/32	1/16	1 1/16	47/64	43/64	2 1/2	3/4
2	1/4 TO 13/16	7/8	7/8	1/16	1 7/16	55/64	51/64	3 1/4	3/4
3	1/2 TO 15/16	1 1/4	7/8	3/32	1 13/32	1 3/32	15/16	3 5/8	3/4

For the information of the members we show the dimensions of both "C" and "D" styles, as have been heretofore made by the various manufacturers.

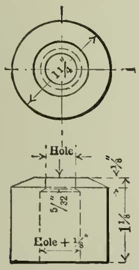
We recommend that style "D" ball-bearing be adopted for all screw-punch purposes, dimensions of which are given in the accompanying table, and that the screws of all cast-steel frames be changed to receive the style "D" punch; also that after this date the punch manufacturers abandon the manufacture of style "C" punch and that all new screw punches of either cast or forged steel frames be equipped with style "D" punches.

Punch No. 1 will fit Nos. 0 and 00 punches.
Punch No. 2 will fit Nos. 1 and 2 punches.
Punch No. 3 will fit Nos. 3 and 4 punches.

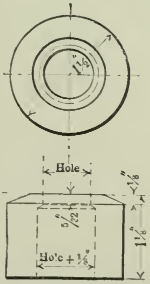
The above arrangement will greatly simplify the screw-punch problem and give us a standard which, we believe, should commend itself to all those interested in the subject, and one which we recommend for adoption.

POWER PUNCH DIES.

The matter of punch dies is a subject which has been given less consideration and attention by the manufacturers than either punches or couplings. These have been made in a haphazard way to almost any size or shape that a customer may specify. The die problem is one which requires immediate revolution and war declared upon the hundred or more different sizes which should be cast aside and the new standard at once brought into



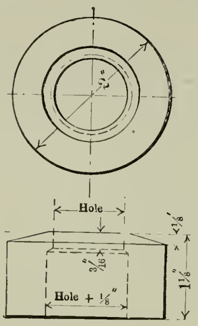
Die No. 1.
⅛ to ⅝.



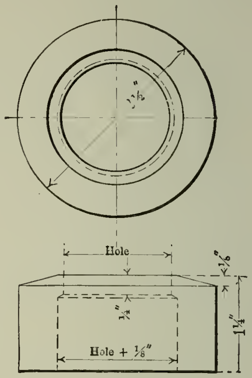
Die No. 2.
½ to ¾.

vogue, if adopted. The committee recommends style "A" die for adoption.

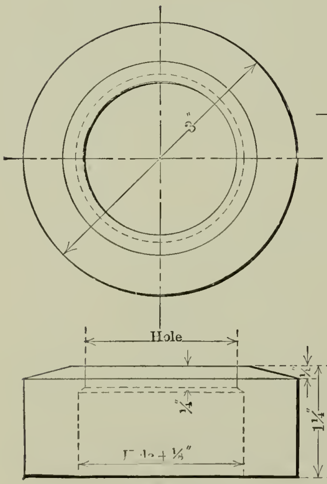
We reproduce a cut from the approved tracing of a number of the standard dies, together with the recommendation of the



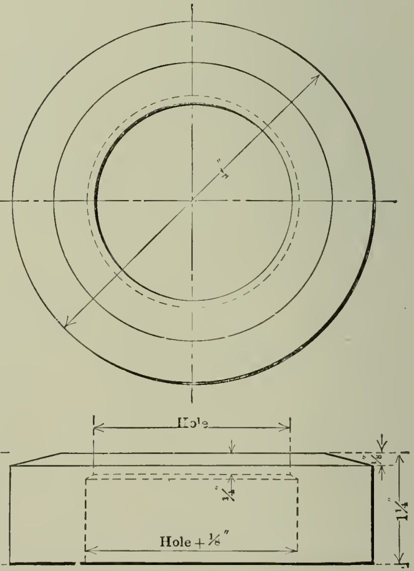
Die No. 3.
¾ to 1¼.



Die No. 4.
1⅛ to 1⅜.

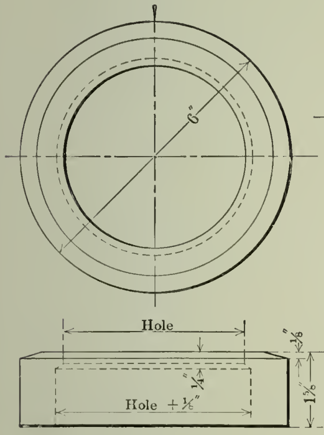


Die No. 5.
1 1/16 to 1⅝.

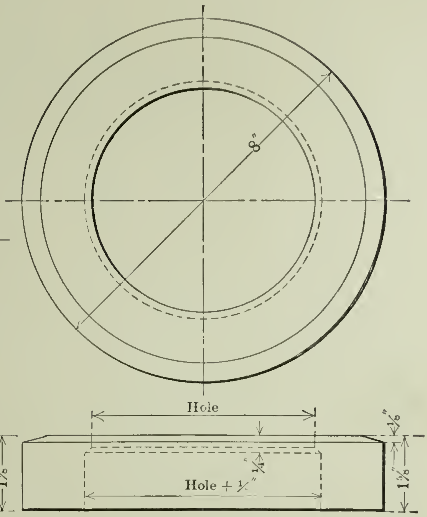


Die No. 6.
1⅝ to 2⅜.

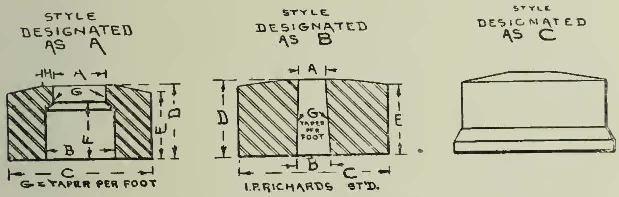
committee, and show eight different sized dies, together with detailed dimensions of those which we recommend for adoption (page 15).



Die No. 7.
2⅝ to 4⅛.



Die No. 8.
4⅛ to 6⅛.



POWER PUNCH DIES.

We show herewith three different styles of dies and have designated them as styles A, B and C. Style A is that which is recommended by your Committee for adoption. See opposite page for detail dimensions of power punch dies.

STANDARD POWER PUNCHING MACHINE DIES, AS MADE BY THE VARIOUS PUNCH MANUFACTURERS; ALSO RECOMMENDATIONS OF THE COMMITEE.

NAME	NO	A	B	C	D	E	F	G	H	NO	A	B	C	D	E	F	G	H
I. P. RICHARDS	1	9/16		1 1/4	3/4	45/64		3/32 to 1"		2	13/16		1 5/8	7/8	13/16		3/32 to 1"	
WICKES BROS.	1	"		"	"	"		"		2	"		"	"	"		"	
CINCINNATI P.&S.CO.	1	"		"	"	"		"		2	"		"	"	"		"	
LONG & ALLSTATTER CO.	1	7/16		"	1/2						11/16		"	5/8				
PRATT & WHITNEY	2	9/64 to 21/64	1/4 to 7/16	3/4	5/8	9/16	5/16	1/4"		3	9/64 to 37/64	1/4 to 11/16	1	3/4	11/16	3/8		
GEO. F. MARCHANT	2	"	"	"	"	"	"	"		3	"	"	"	"	"	"		
GEO. WHITING CO.	2	"	"	"	"	"	"	"		3	"	"	"	"	"	"		
LOVEJOY TOOL WKS	2	"	"	"	"	"	"	"		3	"	"	"	"	"	"		
KLING BROS	2	"	"	"	"	"	"	"		3	"	"	"	"	"	"		
HILLES & JONES		to 9/16		1 1/4	1	15/16		3/4" per foot			to 11/16		1 1/2	1	15/16		3/4 per foot	
AMERICAN DIE & TOOL CO USE P&W STD																		
CLEVELAND P.&S.WKS.CO.	40	1/16 to 7/16	at 1/8	3/4	5/8	1/2	7/16		1/8	42	3/16 to 9/16	at 1/8	1	7/8	3/4	11/16		1/4
WILLIAMS WHITE & CO		9/64 to 1/2	13/64 to 9/16	1 7/16	7/8	13/16	3/4 × D				35/64 to 47/64	19/64 to 51/64	1 11/16	1 1/16	1	3/4 × D		
RECOMMENDED BY J.H. FAHEY CHAIRMAN	1	1/8 to 5/8	D + 1/8	1 1/4	1 1/8	1	31/32	3/4	1/8	2	1/2 × 3/4	D + 1/8	1 1/2	1 1/8	1	31/32	3/4	1/8
T.C. BEST	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
O.C. VOSS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
WM SHOEMAKER	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
J.H. SMYTHE	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
I. P. RICHARDS	7	2 1/16 to		3 7/8	1 1/4	1 9/64		3/32 per inch										
WICKES BROS				"	"	"												
CINCINNATI P.&S. CO.				"	"	"												
LONG & ALLSTATTER CO.		to 2 5/16		4	1 1/4						to 2 3/16		4 1/4	1 3/8				
PRATT & WHITNEY																		
GEO. F. MARCHANT																		
GEO. WHITING CO.																		
LOVEJOY TOOL WKS																		
KLING BROS																		
HILLES & JONES											to 2 1/2		3 15/16	2 3/4	2 9/16		3/4	
AMERICAN DIE & TOOL CO.																		
CLEVELAND P.&S.WKS.CO.	65	5/8 to 1 5/8	at 1/8	2 1/2	1 1/4	1 1/8	1 1/16		3/8	70			2 15/16	1 1/4				
WILLIAMS WHITE & CO.		2 7/64 to 2 9/32	2 15/64 to 2 13/32	4 3/8	2 1/8	2 1/16	3/4 × D				2 23/64 to 2 5/8	2 31/64 to 2 3/4	4 7/8	2 3/8	2 5/16	3/4 × D		
RECOMMENDED BY J.H. FAHEY CHAIRMAN	7	2 5/8 × 4 1/8	D + 1/8	6	1 5/8	1 1/2	1 3/8	3/4	3/8	8	4 1/8 × 6 1/8	D + 1/8	8	1 5/8	1 1/2	1 3/8	3/4	1/2
T. C. BEST	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
O. C. VOSS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
WM SHOEMAKER	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
J. H. SMYTHE	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

NAME	NO	A	B	C	D	E	F	G	H	NO	A	B	C	D	E	F	G	H
I. P. RICHARDS	3	1 1/16		2	1	59/64		3/32 to 1"		4			2 7/16	1 1/8	1 1/32		3/32 per inch	
WICKES BROS.	3			"	"	"		"		4			"	"	"			
CINCINNATI P.&S.CO.	3			"	"	"		"		4			"	"	"			
LONG & ALLSTATTER CO.		1 1/16		2 1/8	7/8						1 5/16		2 1/4	1				
PRATT & WHITNEY	4	17/64 to 29/32	3/8 to 29/32	1 1/2	1	15/16	1/2			5	17/64 to 1 1/32	3/8 to 1 5/32	2	1	15/16	1/2		
GEO. F. MARCHANT	4	"	"	"	"	"	"			5	"	"	"	"	"	"		
GEO. WHITING CO.	4	"	"	"	"	"	"			5	"	"	"	"	"	"		
LOVEJOY TOOL WKS	4	"	"	"	"	"	"			5	"	"	"	"	"	"		
KLING BROS	4	"	"	"	"	"	"			5	"	"	"	"	"	"		
HILLES & JONES		to 15/16		1 3/4	1	15/16		3/4 per foot			to 1 1/16		2	1	15/16		3/4 per foot	
AMERICAN DIE & TOOL CO USE P&W STD																		
CLEVELAND P.&S.WKS.CO.	45	1/4 to 15/16	at 1/8	1 1/4	7/8	3/4	11/16		1/8	53			1 3/4	1				
WILLIAMS WHITE & CO		51/64 to 1 7/64	55/64 to 1 11/64	2 3/16	1 1/4	1 3/16	3/4 × D				1 13/64 to 1 7/16	1 19/64 to 1 17/32	2 11/16	1 1/2	1 7/16	3/4 × D		
RECOMMENDED BY J.H. FAHEY CHAIRMAN	3	3/4 × 1 1/8	D + 1/8	2	1 1/8	1	15/16	3/4	1/8	4	1 1/8 × 1 3/8	D + 1/8	2 1/2	1 1/4	1 1/8	1	3/4	1/8
T.C. BEST	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
O.C. VOSS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
WM SHOEMAKER	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
J.H. SMYTHE	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
I. P. RICHARDS	9	to 3 1/16		5 1/8	1 3/8	1 1/4		3/32 per inch										
WICKES BROS				"	"	"												
CINCINNATI P.&S. CO.				"	"	"												
LONG & ALLSTATTER CO.		to 3 1/16		5	1 1/2						to 3 3/16		5 5/8	1 1/2				
PRATT & WHITNEY																		
GEO. F. MARCHANT																		
GEO. WHITING CO.																		
LOVEJOY TOOL WKS																		
KLING BROS																		
HILLES & JONES											to 3 1/2		4 15/16	2 3/4	2 9/16		3/4	
AMERICAN DIE & TOOL CO.																		
CLEVELAND P.&S.WKS.CO.	71	1 to 2	at 1/8	3	1 1/4	1 1/8	1 1/16		3/8	72	2 to 3	at 1/8	4	1 1/4	1 1/8	1 1/16		1/2
WILLIAMS WHITE & CO.		2 47/64 to 3 1/32	2 53/64 to 3 5/32	5 3/8	2 1/2	2 3/8	3/4 × D				3 9/64 to 3 27/64	3 17/64 to 3 35/64	5 7/8	2 3/4	2 5/8	3/4 × D		
RECOMMENDED BY J.H. FAHEY CHAIRMAN																		
T. C. BEST																		
O. C. VOSS																		
WM SHOEMAKER																		
J. H. SMYTHE																		

NAME	NO	A	B	C	D	E	F	G	H	NO	A	B	C	D	E	F	G	H
I. P. RICHARDS	5	1 9/16 to		2 7/8	1 1/8	1 1/32		3/32 to 1"										
WICKES BROS.				"	"	"												
CINCINNATI P.&S.CO.				"	"	"												
LONG & ALLSTATTER CO.		1 9/16		2 7/8	1 1/8						2 1/16		3 1/4	1 1/4				
PRATT & WHITNEY	6	33/64 to 1 9/32	5/8 to 1 13/32	2 3/8	1 1/4	1 1/8	5/8			7	25/32 to 1 19/32	29/32 to 1 23/32	2 7/8	1 1/4	1 1/8	5/8		
GEO. F. MARCHANT	6	"	"	"	"	"	"			7	"	"	"	"	"	"		
GEO. WHITING CO.	6	"	"	"	"	"	"			7	"	"	"	"	"	"		
LOVEJOY TOOL WKS	6	"	"	"	"	"	"			7	"	"	"	"	"	"		
KLING BROS	6	"	"	2	1	7/8	1/2			7	" to 1 9/16	" to 1 3/8	2	1	7/8	1/2		
HILLES & JONES		to 1 1/2		2 1/2	1 1/8	1		3/4 per foot			to 1 7/8		2 15/16	1 3/4	1 9/16		3/4 per foot	
AMERICAN DIE & TOOL CO USE P&W STD																		
CLEVELAND P.&S.WKS.CO.	59			2	1					63			2 1/4	1 1/4				
WILLIAMS WHITE & CO		1 33/64 to 1 49/64	1 39/64 to 1 55/64	3 7/16	1 1/2	1 7/16	3/4 × D				1 27/32 to 2 1/32	1 15/16 to 2 1/8	3 7/8	1 3/4	1 11/16	3/4 × D		
RECOMMENDED BY J.H. FAHEY CHAIRMAN	5	1 3/8 × 1 5/8	D + 1/8	3	1 1/4	1 1/8	1	3/4	1/4	6	1 5/8 × 2 5/8	D + 1/8	4	1 1/4	1 1/8	1	3/4	1/4
T.C. BEST	"	"	"	"	"	"	"	"		"	"	"	"	"	"	"	"	"
O.C. VOSS	"	"	"	"	"	"	"	"		"	"	"	"	"	"	"	"	"
WM SHOEMAKER	"	"	"	"	"	"	"	"		"	"	"	"	"	"	"	"	"
J.H. SMYTHE	"	"	"	"	"	"	"			"	"	"	"	"	"	"	"	"
I. P. RICHARDS	11	to 4 1/16		6 3/8	1 1/2	1 5/8		3/64 per inch										
WICKES BROS				"	"	"												
CINCINNATI P.&S. CO.				"	"	"												
LONG & ALLSTATTER CO.																		
PRATT & WHITNEY																		
GEO. F. MARCHANT																		
GEO. WHITING CO.																		
LOVEJOY TOOL WKS																		
KLING BROS																		
HILLES & JONES																		
AMERICAN DIE & TOOL CO.																		
CLEVELAND P.&S.WKS.CO.	73	3 to 4 1/2	at 1/8	6	1 5/8	1 1/2	1 7/16		1/2	74	4 1/2 to 6 1/2	at 1/8	8	1 5/8	1 1/2	1 7/16		1/2
WILLIAMS WHITE & CO.		3 43/64 to 3 59/64	3 51/64 to 4 3/64	6 3/8	2 7/8	2 3/4	3/4 × D				4 13/64 to 4 7/32	4 21/64 to 4 11/32	7	3	2 7/8	3/4 × D		
RECOMMENDED BY J.H. FAHEY CHAIRMAN																		
T. C. BEST																		
O. C. VOSS																		
WM SHOEMAKER																		
J. H. SMYTHE																		

SCREW FRAME PUNCH DIES.

The subject of screw punch dies has been given considerable attention and has been reduced to three sizes of the following diameters, 1 5-16, 1⅝ and 1⅞ inches, as with these diameters we are able to accommodate all sizes of screw punches.

FORGED STEEL FRAME SCREW PUNCH DIES

	NAME	NO	A	B	C	D	E	F	G	H
	LOVEJOY TOOL WKS	1	1/8 TO 3/4		1 5/16	7/8				
	AMERICAN DIE & TOOL CO									
	CLEVELAND P & S WKS CO	1			1 5/8	7/8	3/4			
RECOMMENDED BY	J H FAHEY	1½	1/8 TO 3/4	D+1/8	1 5/16	3/4	5/8	19/32	3/4	1/8
	T C BEST	1½	"	"	"	"	"	"	"	"
	O. C VOSS	1½	"	"	"	"	"	"	"	"
	W SHOEMAKER	1½	"	"	"	"	"	"	"	"
	J H SMYTHE	1½	"	"	"	"	"	"	"	

	NAME	NO	A	B	C	D	E	F	G	H
	LOVEJOY TOOL WKS	2			1 5/8	1				
	AMERICAN DIE & TOOL CO									
	CLEVELAND P & S WKS CO	2			1 5/8	1	7/8			
RECOMMENDED BY	J H FAHEY	2½	1/2 TO 7/8	D+1/8	1 5/8	1	7/8	27/32	3/4	1/8
	T C BEST	2½		"	"	"	"	"	"	"
	O. C VOSS	2½	"	"		"	"	"		"
	W SHOEMAKER	2½	"	"	"	"	"	"		
	J H SMYTHE	2½		"	"		"	"		

	NAME	NO	A	B	C	D	E	F	G	H
	LOVEJOY TOOL WKS	3			1 7/8	1 1/16				
	AMERICAN DIE & TOOL CO									
	CLEVELAND P & S WKS CO	3 & 4			1 7/8	1 1/16	15/16			
RECOMMENDED BY	J H FAHEY	3½	3/4 TO 1 1/8	D+1/8	1 7/8	1 1/16	15/16	7/8	3/4	1/8
	T C BEST	3½	"	"					"	
	O. C VOSS	3½	"	"	"	"			"	"
	W SHOEMAKER	3½			"	"	"		"	"
	J H SMYTHE	3½				"	"		"	"

CAST STEEL FRAME SCREW PUNCH DIES

	NAME	NO	A	B	C	D	E	F	G	H
	LOVEJOY TOOL WKS.	1	1/8 TO 3/4		1 5/16	3/4				
	AMERICAN DIE & TOOL CO	A00 B0	"		1 5/16	3/4				
	CLEVELAND P & S WKS CO	0	"		1 5/16	3/4	5/8			
RECOMMENDED BY	J H FAHEY	1½	1/8 TO 3/4	D+1/8	1 5/16	3/4	5/8	19/32	3/4	1/8
	T C BEST	1½	"	"	"	"	"	"	"	"
	O C VOSS	1½	"	"	"	"	"	"	"	"
	W SHOEMAKER	1½	"	"	"	"	"	"	"	"
	J H. SMYTHE	1½	"	"	"	"	"	"	"	"

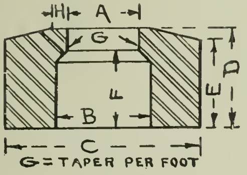
	NAME	NO	A	B	C	D	E	F	G	H
	LOVEJOY TOOL WKS.	2	1/4 TO 7/8		1 9/16	7/8				
	AMERICAN DIE & TOOL CO		"		1 9/16	7/8				
	CLEVELAND P & S WKS CO	1 & 2	"		1 9/16	7/8	3/4			
RECOMMENDED BY	J H FAHEY	2½	1/2 TO 7/8	D+1/8	1 5/8	1	7/8	27/32	3/4	1/8
	T C BEST	2½	"	"	"	"	"	"	"	"
	O C VOSS	2½	"	"	"	"	"	"	"	"
	W SHOEMAKER	2½	"	"	"	"	"	"	"	"
	J H. SMYTHE	2½	"	"	"	"	"		"	"

	NAME	NO	A	B	C	D	E	F	G	H
	LOVEJOY TOOL WKS.	3	3/8 TO 1		1 57/64	7/8				
	AMERICAN DIE & TOOL CO		"		1 7/8	7/8				
	CLEVELAND P & S WKS CO	3	"		1 7/8	7/8	3/4			
RECOMMENDED BY	J H FAHEY	3½	3/4 TO 1 1/8	D+1/8	1 7/8	1 1/16	15/16	7/8	3/4	1/8
	T C BEST	3½	"	"	"	"	"	"	"	"
	O C VOSS	3½	"	"	"	"	"	"	"	"
	W SHOEMAKER	3½	"	"	"	"	"	"	"	
	J H. SMYTHE	3½	"	"	"	"	"	"	"	"

For detailed dimensions see accompanying table, which gives our recommendations in full.

These dies have been given half numbers in order to avoid confusion, as will be seen from a glance at the table, and are as follows:

STYLE "A"



G = TAPER PER FOOT

PROPOSED SCREW PUNCH DIES

INTERNATIONAL STANDARD								
NO	A	B	C	D	E	F	G	H
1½	1/8 TO 3/4	DIAM + 1/8	1 5/16	3/4	5/8	19/32	3/4	1/8
2½	1/2 TO 7/8	" "	1 5/8	1	7/8	27/32	3/4	1/8
3½	3/4 TO 1 1/8	" "	1 7/8	1 1/16	15/16	7/8	3/4	1/8

No. 1½ die intended for Nos. 0 and 00 cast-steel frame punches.

No. 2½ die intended for Nos. 1 and 2 forged and Nos. 1 and 2 cast-steel frame punches.

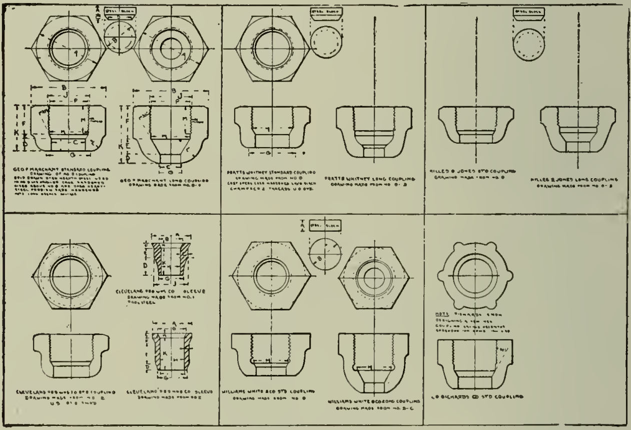
1⅝ inches diameter of die is now 2½—will fit Nos. 1 and 2 punches.

1⅞ inches diameter of die is now 3½—will fit Nos. 3 and 4 punches.

The numbers and dimensions as herein given are hereby recommended by the committee for adoption.

PUNCH COUPLINGS.

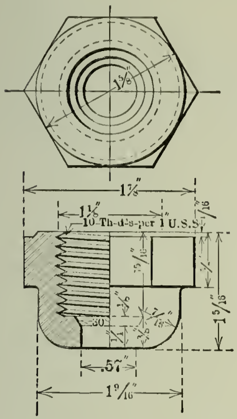
Your Committee has chosen for your consideration a set of couplings which we believe are without fault. The depth of the wrench surface is one of the essential features of these couplings, as many other couplings have been incorrectly constructed. This corrects the evil of the too small wrench surface, which has been found objectionable in the past, especially when the stripper is in position.


GEO F MARCHANT STANDARD COUPLING
GEO F MARCHANT LONG COUPLING
PRATT & WHITNEY STANDARD COUPLING
PRATT & WHITNEY LONG COUPLING
HILLES & JONES STD COUPLING
HILLES & JONES LONG COUPLING
WILLIAMS WHITE & CO STD COUPLING
WILLIAMS WHITE & CO LONG COUPLING
L O RICHARDS CO STD COUPLING

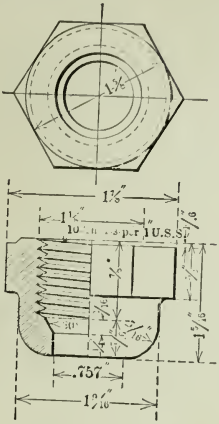
ALL STYLES OF COUPLINGS.

We have selected seven regular and one special coupling. Coupling 38 is a special coupling to be used only in cases where the body of the regular No. 3 coupling is too large, or when holes are to be punched close to the standing flange of angles, channels,

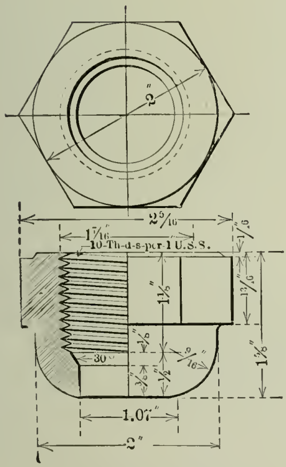
PROPOSED INTERNATIONAL MASTER BOILER MAKERS' STANDARD COUPLINGS.



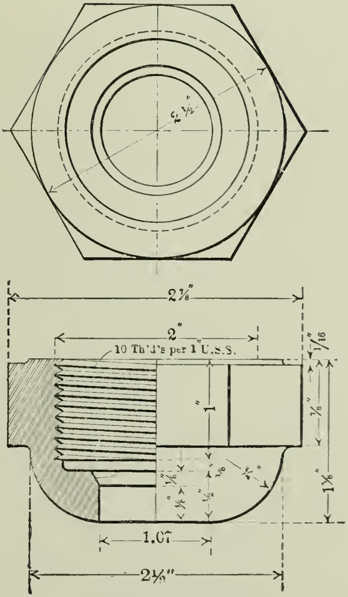
Coupling No. 1.
For Punch No. 1.



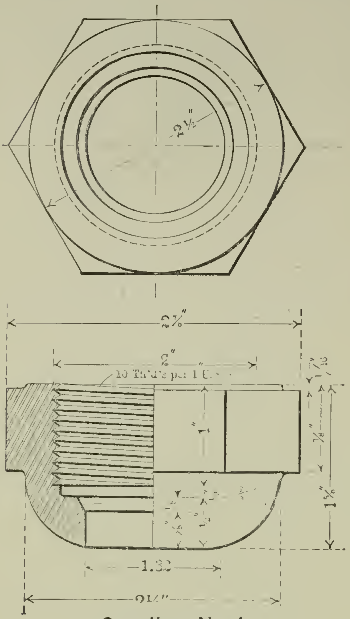
Coupling No. 2.
For Punch No. 2.



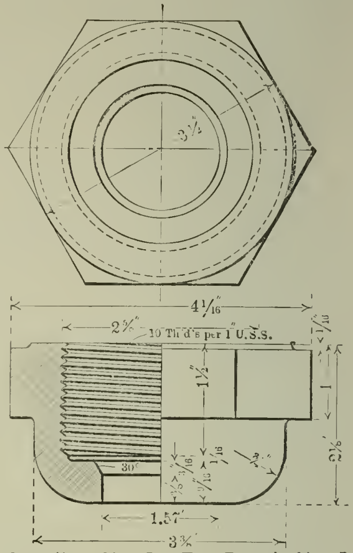
Special.
Coupling No. 3-S.
For No. 3 Punch.
No. 1 Punch with No. 1 Sleeve or
No. 2 Punch with No. 2 Sleeve.



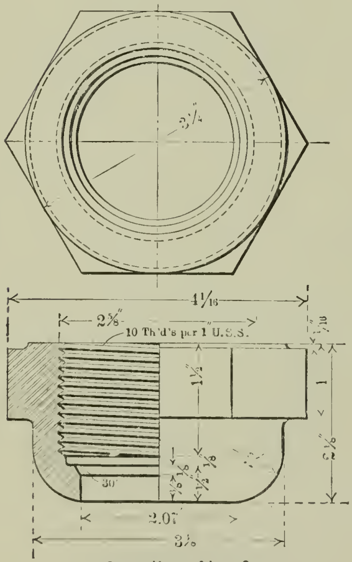
Coupling No. 3.
For No. 3 Punch.
No. 1 Punch with No. 1 Sleeve or
No. 2 Punch with No. 2 Sleeve.



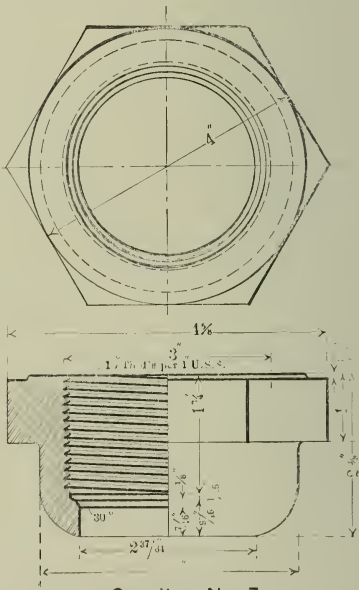
Coupling No 4.
For Punch No. 4.
No Sleeve Required.



Coupling No. 5. For Punch No. 5.



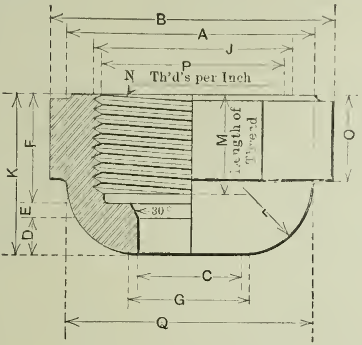
Coupling No. 6.
For Punch No. 6.
No Sleeve Required.



Coupling No. 7.
For Punch No. 7.
Sleeve No. 5 with Punch No. 5 or
Sleeve No. 6 with Punch No. 6.

beams or the flanges of heads, etc., and the only reason that this coupling is shown at all, is in case it may at some time be necessary to resort to the use of such a coupling; hence we have given the dimensions for the benefit of those who may be obliged to use it.

We show in this report several makes of couplings, all of which are laid out to the same scale. We also reproduce a cut of the tracing containing the dimensions recommended by the Committee.



PROPOSED INTERNATIONAL STANDARD POWER PUNCH COUPLINGS.

We also produce herewith detailed drawings and dimensions of the couplings which we take pleasure in recommending to the Association for adoption.

PROPOSED

INTERNATIONAL STANDARD POWER PUNCH COUPLINGS

NO	A	B	C	D	E	F	G	J	K	L	M	N	O	P	Q
1	$1\frac{5}{8}$	$1\frac{7}{8}$	.57	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{15}{16}$	$\frac{3}{4}$	$1\frac{1}{8}$	$1\frac{5}{16}$	$\frac{7}{16}$	$\frac{15}{16}$	10	$\frac{5}{8}$	1.095	$1\frac{9}{16}$
2	$1\frac{5}{8}$	$1\frac{7}{8}$	.757	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{7}{8}$	$\frac{13}{16}$	$1\frac{1}{8}$	$1\frac{5}{16}$	$\frac{7}{16}$	$\frac{7}{8}$	10	$\frac{5}{8}$	1.095	$1\frac{9}{16}$
3S	2	$2\frac{5}{16}$	1.07	$\frac{3}{8}$	$\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{5}{64}$	$1\frac{7}{16}$	$1\frac{5}{8}$	$\frac{9}{16}$	$1\frac{1}{8}$	10	$\frac{13}{16}$	1.307	2
3	$2\frac{1}{2}$	$2\frac{7}{8}$	1.07	$\frac{3}{8}$	$\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{5}{64}$	2	$1\frac{5}{8}$	$\frac{3}{4}$	1	10	$\frac{7}{8}$	1.87	$2\frac{1}{2}$
4	$2\frac{1}{2}$	$2\frac{7}{8}$	1.32	$\frac{3}{8}$	$\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{11}{32}$	2	$1\frac{5}{8}$	$\frac{3}{4}$	1	10	$\frac{7}{8}$	1.87	$2\frac{1}{2}$
5	$3\frac{1}{2}$	$4\frac{1}{16}$	1.57	$\frac{3}{8}$	$\frac{3}{16}$	$1\frac{9}{16}$	$2\frac{1}{8}$	$2\frac{5}{8}$	$2\frac{1}{8}$	$\frac{3}{4}$	$1\frac{1}{2}$	10	1	2.495	$3\frac{3}{8}$
6	$3\frac{1}{2}$	$4\frac{1}{16}$	2.07	$\frac{3}{8}$	$\frac{1}{8}$	$1\frac{5}{8}$	$2\frac{1}{8}$	$2\frac{5}{8}$	$2\frac{1}{8}$	$\frac{3}{4}$	$1\frac{1}{2}$	10	1	2.495	$3\frac{3}{8}$
7	4	$4\frac{5}{8}$	2.57	$\frac{7}{16}$	$\frac{1}{8}$	$1\frac{13}{16}$	$2\frac{5}{8}$	3	$2\frac{3}{8}$	$\frac{3}{4}$	$1\frac{3}{4}$	10	1	2.87	$3\frac{3}{4}$

While we do not feel justified at this time to recommend the quality of material to be used in punches and dies, the Committee is of the unanimous opinion that couplings should be made of mild steel, drop forged and case hardened.

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STANDARD PUNCH COUPLINGS AS MADE BY THE VARIOUS PUNCH MANUFACTURERS; ALSO RECOMMENDATIONS OF THE COMMITTEE.

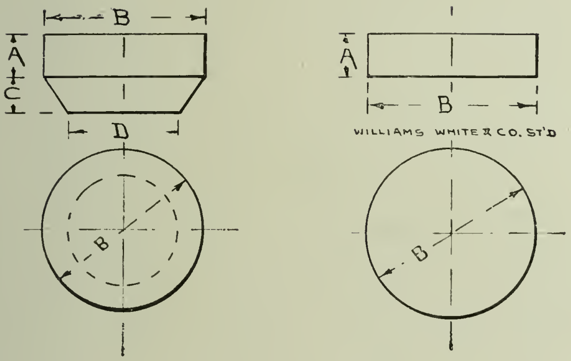
NAME	NO	A	B	C	D	E	F	G	H	J	K	L	M	N	P
I.R. RICHARDS CO.	0	1 7/16		27/64	1/4	3/16	5/8		603	11/16	1 1/16		37/64	14	643
WICKES BROS	0	"	"	"	"	"	"	"	"	"	"		"	"	"
CINCINNATI P&S. CO.	0	"	"		"	"	"	"	"	"	"		"	"	"
LONG & ALLSTATTER CO.	0	"	"	13/32	"	"	"	"	"	"	1		"	"	"
PRATT & WHITNEY CO	2	1 1/8	1 5/16	7/16	9/32	3/32	9/16		37/64	11/16	15/16		9/16	14	37/64
GEO. WHITING CO	2	"	"	"	"	"	"		"	"	"		"	"	"
KLING BROS.	2	"	"	"	"	"	"		"	"	"		"	"	"
LOVEJOY TOOL WKS	2	"	"	"	"	"	"		"	"	"		"	"	"
GEO. F. MARCHANT	2	"	"	"	"	"	"		"	"	"			"	"
HILLES & JONES CO.	2	"	1 5/32	"	1/4	"	19/32		9/16	"	15/16		1/2	14	
CLEVELAND P&S. WKS CO	0	1 5/8	1 7/8	37/64	1/4	1/8	15/16	13/16		1 1/8	1 5/16	3/8	7/8	10	
WILLIAMS WHITE & CO	B	1 1/8	1 5/16	7/16	1/4					11/16	1			12	
AMERICAN DIE & TOOL WKS USE DEW STD															
RECOMMENDED BY J.R. FAHEY CHAIRMAN	1	1 5/8	1 7/8	37/64	1/4	1/8	15/16	13/16		1 1/8	1 5/16	3/8	15/16	10	
T.C. BEST	"	"	"	"	"	"	"			"	"	"	"	"	
O.C. VOSS	"	"	"	"	"	"	"	"		"		"	"	"	
WM. SHOEMAKER	"	"	"	"	"	"	"	"		"	"	"	"	"	
J.M. SMYTHE															
L.P. RICHARDS CO.	4	2 3/8		1 21/64	7/16	3/16	7/8		1557	1 1/16	1 1/2		25/32	10	1557
WICKES BROS	4	"	"	"	"	"	"		"	"	"		"	"	"
CINCINNATI P&S CO	4	"	"	"	"	"	"		"	"	"		"	"	
LONG & ALLSTATTER CO.	4	2 5/16	"	1 5/16			"				"		3/4		
PRATT & WHITNEY CO.	6	2 1/4	2 5/8	1.40	19/32	7/32	13/16		1 15/32	1 9/16	1 1/2		13/16	12	1 15/32
GEO WHITING CO	6	"	"	"	"	"	"		"	"				"	"
KLING BROS	6	"	"	"	"	"	"		"	"					
LOVEJOY TOOL WKS	6	"	"	"	"	"	"		"	"	"			"	"
GEO F MARCHANT	6	2 5/16	2 11/16	"	7/16	"	"		"		"		"	"	
HILLES & JONES CO.	6	2 7/16	2 5/8	"	5/16	5/32	29/32		1 7/16	"	1 3/8		3/4		
CLEVELAND P&S WKS CO	3 1/2	2 1/4	2 7/8	1 9/64	3/8	1/8	1 1/8	1 1/8		2	1 5/8	3/4	21/32	10	
WILLIAMS WHITE & CO.	F	2 1/2		1 1/4	3/8					1 13/16	1 7/8			12	
AMERICAN DIE & TOOL WKS USE DEW ST'D															
RECOMMENDED BY J.M. FAHEY	4	2 1/2	2 7/8	1 21/64	3/8	1/8	1 1/8	1 11/32		2	1 5/8	3/4	1	10	
T.C. BEST	"	"	"	"	"	"	"	"		"	"	"	"	"	
O.C. VOSS	"	"	"	"	"	"	"	"		"	"	"	"	"	
W.B. SHOEMAKER	"	"	"	"	"	"	"	"		"	"	"	"	"	
J.M. SMYTHE															
I.P. RICHARDS CO	8	3 3/4		2 37/64	1/2	5/16	1 1/16		2.810	3	1 7/8		1	10	2.810
WICKES BROS	8	"	"	"	"	"	"		"	"	"		"	"	"
CINCINNATI P&S CO	8	"	"	"	"	"	"		"	"	"		"	"	"
LONG & ALLSTATTER	8	"	"	2 9/16	"	"	"		"	"	"		15/16	"	
PRATT & WHITNEY CO	10	4 1/4	4 7/8	2 11/16	17/32	3/8	1 1/8		3 7/64	3 1/4	2 1/32		1 1/16	8	3 7/64
GEO. WHITING CO	10	"	"	"	"	"			"	"					"
KLING BROS	10	"	"	"	"	"	"		"	"	"		"	"	
LOVEJOY TOOL WKS	10		"	"	"	"	"		"	"	"		"		"
GEO F MARCHANT	10	"	"	"	"	"	"		"	"	2 1/8		"	"	"
HILLES & JONES CO	10	"	"	"	13/32	9/32	1 1/4		3	3 1/4	1 15/16		1		
CLEVELAND P&S WKS CO	7	4	4 3/8	2 37/64	7/16	1/8	1 13/16			3	2 3/8	23/32	1 3/4	10	
WILLIAMS WHITE & CO.	J	4 1/4	4 3/8	2 5/8	9/16					3 1/4	2 1/2			12	
AMERICAN DIE & TOOL WKS USE DEW STD															

NAME	NO	A	B	C	D	E	F	G	H	J	K	L	M	N	P
I.R. RICHARDS CO.	1	1 3/8		37/64	3/8	7/32	3/4		767	7/8	1 3/32		37/64	12	767
WICKES BROS	1	"	"	"	"	"	"		"	"	"		"	"	"
CINCINNATI P&S. CO.	1	"	"	"	"	"	"		"	"	"		"	"	"
LONG & ALLSTATTER CO.	1	"	"	9/16	"	"	"		"	"	1 5/16		5/8	"	"
PRATT & WHITNEY CO	3	1 7/16	1 11/16	5/8	5/32	1/8	11/16		25/32	7/8	1 3/32		11/16	12	25/32
GEO. WHITING CO	3	"	"	"	"	"	"		"	"	"		"	"	"
KLING BROS.	3	"	"	"	"	"	"		"	"	"		"	"	"
LOVEJOY TOOL WKS	3	"	"	"	"	"	"		"	"	"			"	"
GEO. F. MARCHANT	3	"	"	"	"	"	"		"	"	1 1/8		"	"	"
HILLES & JONES CO.	3	"	"	"	1/4	7/64	47/64		3/4	"	1 3/32		5/8	"	
CLEVELAND P&S. WKS CO	1	1 5/8	1 7/8	49/64	1/4	3/16	7/8	7/8		1 1/8	1 5/8	3/8	13/16	10	
WILLIAMS WHITE & CO	C	1 7/16	1 11/16	5/8	5/16					7/8	1 3/8			12	
AMERICAN DIE & TOOL WKS USE DEW STD															
RECOMMENDED BY J.R. FAHEY CHAIRMAN	2	1 5/8	1 7/8	49/64	1/4	3/16	7/8	7/8		1 1/8	1 5/16	3/8	7/8	10	
T.C. BEST	"	"	"		"	"	"	"		"		"	"	"	
O.C. VOSS	"	"	"	"	"	"	"	"		"	"	"	"	"	
WM. SHOEMAKER	"	"	"	"	"	"	"			"	"	"	"	"	
J.M. SMYTHE															
L.P. RICHARDS CO.	5	2 3/4		1 37/64	7/16	9/32	1		1870	2	1 23/32		31/32	10	1870
WICKES BROS	5	"	"	"	"	"				"	"		"	"	"
CINCINNATI P&S CO	5			"		"			"				"	"	"
LONG & ALLSTATTER CO.	5	2 13/16	"	1 9/16							1 11/16		7/8		"
PRATT & WHITNEY CO.	7	2 1/2	2 7/8	1 9/16	15/32	7/32	7/8		1 25/32	1 7/8	1 9/16		13/16	12	1 25/32
GEO WHITING CO	7	"	"	"		"				"	"		"	"	"
KLING BROS	7	"	"		"		"		"		"		"		"
LOVEJOY TOOL WKS	7	"	"	"							"			"	
GEO F MARCHANT	7	2 5/8	3 1/16				"		"		1 11/16		"	"	
HILLES & JONES CO.	7	2 9/16	2 15/16	1 9/16	5/16	3/16	15/16		1 3/4	"	1 7/16		3/4	"	
CLEVELAND P&S WKS CO	4	2 1/2	2 7/8	1 21/64	3/8	1/8	1 1/8	1 11/32		2	1 5/8	3/4	31/32	10	
WILLIAMS WHITE & CO.	G	2 3/4		1 9/16	3/8					2	1 7/8			12	
AMERICAN DIE & TOOL WKS USE DEW ST'D															
RECOMMENDED BY J.M. FAHEY	5	3 1/2	4 1/16	1 37/64	3/8	3/16	1 9/16	2		2 5/8	2 1/8	3/4	1 1/2	10	
T.C. BEST	"	"	"	"	"	"	"	"			"	"	"	"	
O.C. VOSS	"	"	"	"	"	"	"	"		"		"	"	"	
W.B. SHOEMAKER	"	"	"	"	"	"	"	"		"	"	"		"	
J.M. SMYTHE															
I.P. RICHARDS CO	9	4 3/8		3 5/64	1/2	5/16	1 1/8		3.370	3 1/2	1 15/16		1 1/32	10	3.370
WICKES BROS	9	"	"	"	"	"	"			"	"		"	"	"
CINCINNATI P&S CO	9		"		"		"		"	"	"		"	"	
LONG & ALLSTATTER	9	"		3 1/16					"	"	2		1	"	"
PRATT & WHITNEY CO	11	5	5 3/4	3 5/16	17/32	5/16	1 5/16		3 23/32	3 7/8	2 5/32		1 1/4	8	3 23/32
GEO. WHITING CO	11			"						"			"	"	"
KLING BROS	11	"		"							"			"	"
LOVEJOY TOOL WKS	11	"	"	"		"					"			"	"
GEO F MARCHANT	11	5 1/4	6	"	"	"	"		"		2 3/8		"	"	"
HILLES & JONES CO	11	5	5 3/4	"	21/32	9/32	1 3/8		3 5/8	"	2 5/16		1 1/8	"	
CLEVELAND P&S WKS CO															
WILLIAMS WHITE & CO.	K	5	5 3/4	3 1/4	3/4					4	3 1/4			8	
AMERICAN DIE & TOOL WKS USE DEW STD															

NAME	NO	A	B	C	D	E	F	G	H	J	K	L	M	N	P
I.R. RICHARDS CO.	2	1 3/4		53/64	5/16	3/16	13/16		995	1 1/8	1 5/16		43/64	10	995
WICKES BROS	2	"	"	"	"	"	"		"	"	"		"	"	"
CINCINNATI P&S. CO.	2	"	"	"	"	"	"		"	"	"		"	"	"
LONG & ALLSTATTER CO.	2	1 11/16	"	13/16	"	"	"		"	"	1 1/4		11/16	"	"
PRATT & WHITNEY CO	4	1 11/16	1 15/16	13/16	11/32	5/32	11/16		31/32	1 1/16	1 3/16		11/16	12	31/32
GEO. WHITING CO	4	"	"	"	"	"	"		"	"	"		"	"	"
KLING BROS.	4	"	"	"	"	"	"		"	"	"		"	"	"
LOVEJOY TOOL WKS	4	"	"	"	"	"	"		"	"	"		"	"	"
GEO. F. MARCHANT	4	1 3/4	2	"	"	"	"		"	"	"		"	"	"
HILLES & JONES CO.	4	1 11/16	1 15/16	"	5/16	1/8	3/4		15/16	"	"		5/8	"	"
CLEVELAND P&S. WKS CO	2	2	2 5/16	1 9/64	11/32	5/32	13/16	1 1/8		1 3/8	1 5/16	3/8	13/16	10	
WILLIAMS WHITE & CO	D	1 1/8		13/16	9/16					1 1/4	1 1/2			12	
AMERICAN DIE & TOOL WKS USE DEW STD															
RECOMMENDED BY J.R. FAHEY CHAIRMAN	35	2	2 5/16	1 5/64	3/8	1/8	1 1/8	1 1/8		1 7/16	1 5/8	3/8	1 1/8	10	
T.C. BEST	"	"	"	"	"	"	"	"		"	"	"	"	"	
O.C. VOSS	"	"	"	"	"	"	"	"		"	"	"	"	"	
WM. SHOEMAKER	"	"	"	"	"	"	"	"		"	"	"	"	"	
J.M. SMYTHE															
L.P. RICHARDS CO.	6	3		1 53/64	7/16	5/16	1		2182	2 5/16	1 3/4		15/16	10	2182
WICKES BROS	6	"	"	"	"	"	"		"	"	"	"	"	"	"
CINCINNATI P&S CO	6	"	"	"	"	"	"		"	"	"	"	"	"	"
LONG & ALLSTATTER CO.	6	"	"	1 13/16	"	"	"		"	"	1 11/16	"	7/8	"	"
PRATT & WHITNEY CO.	8	3	3 1/2	1 11/16	17/32	9/32	7/8		2 5/32	2 1/4	1 11/16		13/16	12	2 5/32
GEO WHITING CO	8	"	"	"	"	"	"		"	"	"		"	"	"
KLING BROS	8	"	"	"		"	"		"	"	"		"	"	"
LOVEJOY TOOL WKS	8	"	"	"	"	"	"		"	"	"		"	"	"
GEO F MARCHANT	8	3 1/4	3 3/4	"	"	"	"		"	"	1 3/4		"	"	"
HILLES & JONES CO.	8	3	3 1/2	"	3/8	1/4	15/16		2 3/32	"	1 9/16		3/4	"	
CLEVELAND P&S WKS CO	5	3 1/2	4 1/16	1 37/64	5/16	1/4	2 9/16	2		2 5/8	2 1/8	3/4	1 7/16	10	
WILLIAMS WHITE & CO.	H	3 1/8		1 3/4	7/16					2 1/4	2			12	
AMERICAN DIE & TOOL WKS USE DEW ST'D															
RECOMMENDED BY J.M. FAHEY	6	3 1/2	4 1/16	2 5/64	3/8	1/8	1 13/16			2 5/8	2 1/8	23/32	1 1/2	10	
T.C. BEST	"	"	"	"	"	"	"			"	"	"	"	"	
O.C. VOSS	"	"	"	"	"	"	"			"	"	"	"	"	
W.B. SHOEMAKER	"	"	"	"	"	"	"			"	"	"	"	"	
J.M. SMYTHE															
I.P. RICHARDS CO	10	4 7/8		3 37/64	1/2	5/16	1 1/4		3.870	4	2 9/16		1 5/32	10	3.870
WICKES BROS	10	"	"	"		"	"		"	"	"		"	"	"
CINCINNATI P&S CO	10					"	"		"	"	"		"	"	"
LONG & ALLSTATTER	10	"	"	3 5/16	"		"		"	"	"		1 1/8	"	"
PRATT & WHITNEY CO	12	6 1/8	7 1/16	4 3/16	9/16	13/32	1 13/16		4 43/64	4 7/8	2 25/32		1 3/4	6	4 43/64
GEO. WHITING CO	12	"	"	"	"	"	"		"	"	"		"	"	
KLING BROS	12	"	"	"	"	"	"		"	"	"		"	"	"
LOVEJOY TOOL WKS	12	"	"		"	"	"		"	"	"		"	"	"
GEO F MARCHANT	12	6 1/2	7 1/2	"	"	"	"		"	"	3		"	"	"
HILLES & JONES CO	12	6 1/8	7 1/16	"	15/32	11/32	1 15/16		4 9/32	"	2 3/4		1 5/8	"	
CLEVELAND P&S WKS CO	"														
WILLIAMS WHITE & CO.	L	6 1/4		4 1/8						5				8	
AMERICAN DIE & TOOL WKS USE DEW STD															

NAME	NO	A	B	C	D	E	F	G	H	J	K	L	M	N	P
I.R. RICHARDS CO.	3	2		1 5/64	3/8	3/16	7/8		1.276	1 11/32	1 7/16		[illegible]	10	[illegible]
WICKES BROS	3	"	"	"	"	"	"		"	"	"		"	"	"
CINCINNATI P&S. CO.	3	"	"	"	"	"	"		"	"	"		"	"	"
LONG & ALLSTATTER CO.	3	"	"	1 1/16	"	"	"		"	"	1 3/8		3/4	"	"
PRATT & WHITNEY CO	5	2	2 1/4	1.80	13/32	5/32	11/16		1 7/32	1 5/16	1 1/4		11/16	12	1 7/32
GEO. WHITING CO	5	"	"	"	"	"	"		"	"	"		"	"	"
KLING BROS.	5	"	"	"	"	"	"		"	"	"		"	"	"
LOVEJOY TOOL WKS	5	"	"	"	"	"	"		"	"	"		"	"	"
GEO. F. MARCHANT	5	"	2 5/16	"	3/8	"	"		"	"	1 3/8		"	"	"
HILLES & JONES CO.	5	"	2 1/4	"	3/8	1/8	3/4		1 3/16	1 5/16	1 1/8		5/8	"	
CLEVELAND P&S. WKS CO	3	2 1/4	2 5/8	1 5/64	11/32	5/32	1 1/16	7/8		1 3/8	1 5/8	3/8	1 1/16	10	
WILLIAMS WHITE & CO	E	2 1/4		1 1/16	3/8					1 1/2	1 5/8			12	
AMERICAN DIE & TOOL WKS USE DEW STD															
RECOMMENDED BY J.R. FAHEY CHAIRMAN	3	2 1/2	2 5/8	1 5/64	3/8	1/8	1 1/8	1 1/8		2	1 5/8	3/4	1	10	
T.C. BEST	"	"	"	"	"	"	"	"		"	"	"	"	"	
O.C. VOSS	"	"	"	"	"	"	"	"		"	"	"	"	"	
WM. SHOEMAKER	"	"	"	"	"	"	"	"		"	"	"	"	"	
J.M. SMYTHE															
L.P. RICHARDS CO.	7	3 3/16		2 5/64	1/2	3/8	1 1/16		2.495	2 5/8	1 15/16		33/32	10	2495
WICKES BROS	7	"	"	"	"	"	"		"	"	"		"	"	"
CINCINNATI P&S CO	7	"	"	"	"	"	"		"	"	"		"	"	"
LONG & ALLSTATTER CO.	7	3 3/8	"	2 1/16	"	"	"		"	"	1 3/4		15/16	"	"
PRATT & WHITNEY CO.	9	3 3/4	4 3/8	2 5/16	17/32	1/4	1 1/32		2 21/32	2 1/4	1 13/16		15/16	12	2 21/32
GEO WHITING CO	9	"	"	"	"	"	"		"	"	"		"	"	"
KLING BROS	9	"	"	"	"	"	"		"	"	"		"	"	"
LOVEJOY TOOL WKS	9	"	"	"	"	"	"		"	"	"		"	"	"
GEO F MARCHANT	9	"	"	"	"	"	"		"	"	1 7/8		"	"	"
HILLES & JONES CO.	9	"	"	"	1/2	7/32	1 3/32		2 19/32	"	1 13/16		7/8	"	
CLEVELAND P&S WKS CO	6	3 1/2	4 1/16	2 5/64	9/32	3/16	1 21/32			2 5/8	2 1/8	23/32	1 1/2	10	
WILLIAMS WHITE & CO.	I	3 3/4	4 3/8	2 1/4	9/16					2 3/4	2 1/4			12	
AMERICAN DIE & TOOL WKS USE DEW ST'D															
RECOMMENDED BY J.M. FAHEY	7	4	4 5/8	2 37/64	7/16	1/8	1 13/16			3	2 3/8	23/32	1 3/4	10	
T.C. BEST	"	"	"	"	"	"	"			"	"	"	"	"	
O.C. VOSS	"	"	"	"	"	"	"			"	"	"	"	"	
W.B. SHOEMAKER	"	"	"	"	"	"	"			"	"	"	"	"	
J.M. SMYTHE															
I.P. RICHARDS CO	11	5 11/16		4 5/64	1/2	15/32	1 1/4		4.620	4 3/4	2 7/32		1 7/32	10	4.620
WICKES BROS	11		"	"	"	"	"		"	"	"		"	"	"
CINCINNATI P&S CO	11	"	"	"	"	"	"		"	"	"		"	"	"
LONG & ALLSTATTER	11	"		4 1/16	"	"	"		"	"	"		1 1/8	"	"
PRATT & WHITNEY CO															
GEO. WHITING CO															
KLING BROS															
LOVEJOY TOOL WKS															
GEO F MARCHANT															
HILLES & JONES CO															
CLEVELAND P&S WKS CO															
WILLIAMS WHITE & CO.															
AMERICAN DIE & TOOL WKS USE DEW STD															

STEEL FILLER BLOCKS.



For detail dimensions of these steel filler blocks as made by the various manufacturers see opposite page.

STEEL FILLER BLOCKS AS MADE BY THE VARIOUS PUNCH MANUFACTURERS.

NAME	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D
PRATT & WHITNEY	3/2	1/32	23/32	3/32	11/32	4/3	—	29/32	—	—	4/2	1/32	29/32	3/16	17/32	4/5	3/16	1 5/32	1/4	29/32
KLING BROS	"	"	"	"	"	"	—	"	—	—	"	"	"	"	"	"	"	"	"	"
GEO. WHITING CO.	"	"	"	"	"	"	—	"	—	—	"	"	"	"	"	"	"	"	"	"
AMERICAN DIE & TOOL WKS	"	"	"	"	"	"	—	"	—	—	"	"	"	"	"	"	"	"	"	"
LOVEJOY TOOL WKS	"	"	"	"	"	"	—	"	—	—	"	"	"	"	"	"	"	"	"	"
GEO F MARCHANT	"	1/8	"	1/16	17/32	"	—	—	—	—	"	5/32	"	1/16	"	"	5/32	"	9/32	"
MILLES & JONES	"	5/32	"	"	"	"	—	23/32	1/16	23/32	"	—	"	7/32	7/32	"	1/32	"	3/32	"
I P RICHARDS																				
WICKES BROS																				
CINCINNATI P&S CO																				
LONG & ALLSTATTER CO																				
CLEVELAND P&S WKS CO.																				
WILLIAMS WHITE & CO.	C/B	1/4	11/16			D/C	5/16	7/8			E/D	3/8	1 3/16			F/E	1/4	1 7/16		
RECOMMENDED BY THE COMMITTEE J.H. FAHEY CHAIRMAN																				
T.C. BEST																				
O.C. VOBS																				
WM SHOEMAKER																				
J.H. SMYTHE																				

NAME	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D
PRATT & WHITNEY	5/3	3/16	1 5/32	9/32	23/32	5/2	3/16	1 5/32	15/32	17/32	6/5	3/16	1 3/8	1/4	1 5/32	6/4	7/16	1 3/8	7/16	29/32
KLING BROS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
GEO. WHITING CO.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
AMERICAN DIE & TOOL WKS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
LOVEJOY TOOL WKS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
GEO F MARCHANT	"	5/32	"	5/16	"	"	5/32	"	1/2	"	"	"	"	—	"	"	3/16	"	11/16	"
MILLES & JONES	"		"	"	"	"	7/32	"	"	"	"	11/32	"	3/32	"	"	9/16	"	5/16	"
I P RICHARDS																				
WICKES BROS																				
CINCINNATI P&S CO																				
LONG & ALLSTATTER CO																				
CLEVELAND P&S WKS CO.																				
WILLIAMS WHITE & CO.	G/F	3/8	1 11/16			H/G	1/4	2			I/H	1/2	2 1/4			J/I	3/8	2 3/4		
RECOMMENDED BY THE COMMITTEE J.H. FAHEY CHAIRMAN																				
T.C. BEST																				
O.C. VOBS																				
WM SHOEMAKER																				
J.H. SMYTHE																				

NAME	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D
PRATT & WHITNEY	6/3	7/16	1 3/8	15/32	23/32	7/6	3/16	1 11/16	1/8	1 3/8	7/5	3/8	1 11/16	3/8	1 5/32	7/4	5/8	1 11/16	5/16	29/32
KLING BROS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
GEO. WHITING CO.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
AMERICAN DIE & TOOL WKS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
LOVEJOY TOOL WKS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
GEO F MARCHANT	"	3/16	"	23/32	"	"	"	"	"	"	"	3/16	"	9/16	"	"	3/16	"	1	"
MILLES & JONES	"	13/32	"	"	"	"	3/16	"	"	"	"	3/8	"	"	"	"	5/8	"	"	"
I P RICHARDS																				
WICKES BROS																				
CINCINNATI P&S CO																				
LONG & ALLSTATTER CO																				
CLEVELAND P&S WKS CO.																				
WILLIAMS WHITE & CO.																				
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O.C. VOBS																				
WM SHOEMAKER																				
J.H. SMYTHE																				

NAME	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D
PRATT & WHITNEY	7/3	15/32	1 11/16	3/4	23/32	7/8	5/32	2 1/16	5/32	1 11/16	8/6	1/4	2 1/16	3/8	1 3/8	9/8	—	—	—	—
KLING BROS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—
GEO WHITING CO.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—
AMERICAN DIE & TOOL WKS.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—
LOVEJOY TOOL WKS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—
GEO F MARCHANT	"	3/16	"	1 1/32	"	"	3/16	"	1/16	"	"	"	"	"	"	"	—	—	—	—
MILLES & JONES	"	7/16	"	"	"	8/7	5/32	"	"	"	"	1/32	"	13/32	"	"	—	2 9/16	—	2 1/16
I P RICHARDS																				
WICKES BROS																				
CINCINNATI P&S CO																				
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WM SHOEMAKER																				
J.H. SMYTHE																				

NAME	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D
PRATT & WHITNEY	9/7	1/16	2 9/16	1/4	1 11/16	9/6	1/4	2 9/16	3/8	1 3/8	9/5	1/2	2 9/16	9/16	1 5/32	11/10	—	3 19/32	—	—
KLING BROS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	"	—	—
GEO WHITING CO.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	"	—	—
AMERICAN DIE & TOOL WKS.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	"	—	—
LOVEJOY TOOL WKS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	"	—	—
GEO F MARCHANT	"	1/4	"	1/16	"	"	"	"	"	"	"	1/4	"	13/16	"	"	—	"	—	—
MILLES & JONES	"	5/32	"	5/32	"	"	"	"	"	"	10/7	5/32	2 3/8	5/32	1 11/16					
I P RICHARDS																				
WICKES BROS																				
CINCINNATI P&S CO																				
LONG & ALLSTATTER CO																				
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NAME	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D	NO	A	B	C	D
PRATT & WHITNEY	11/9	5/32	3 19/32	3/32	3 1/4	12/11	3/16	4 1/2	3/16	3 19/32	12/10	1/4	4 1/2	1/4	4	12/9	1/4	4 1/2	3/8	3 1/2
KLING BROS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
GEO WHITING CO.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
AMERICAN DIE & TOOL WKS.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
LOVEJOY TOOL WKS	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
GEO F MARCHANT	"	1/8	"	1/8	2 9/16	"	1/8	"	1/2	"	"	"	"	"	3	"	"	"	"	2 9/12
MILLES & JONES																				
I P RICHARDS																				
WICKES BROS																				
CINCINNATI P&S CO																				
LONG & ALLSTATTER CO																				
CLEVELAND P&S CO.																				
WILLIAMS WHITE & CO																				
RECOMMENDED BY THE COMMITTEE J.H. FAHEY																				
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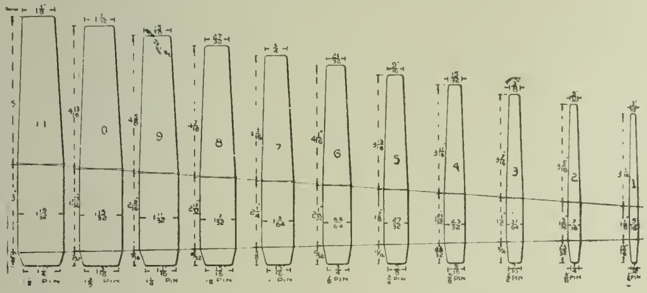
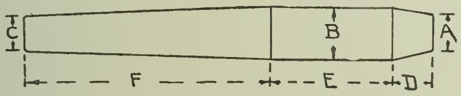
J.H. SMYTHE																				

PINS.

There was a time in the history of boiler-making when drill pins were used very extensively and were an absolute necessity. There is, however, a vast difference between the use and abuse of anything. Drift pins may have been used to the extreme, but not so much so as has been talked of by men who are not so familiar with the subject.

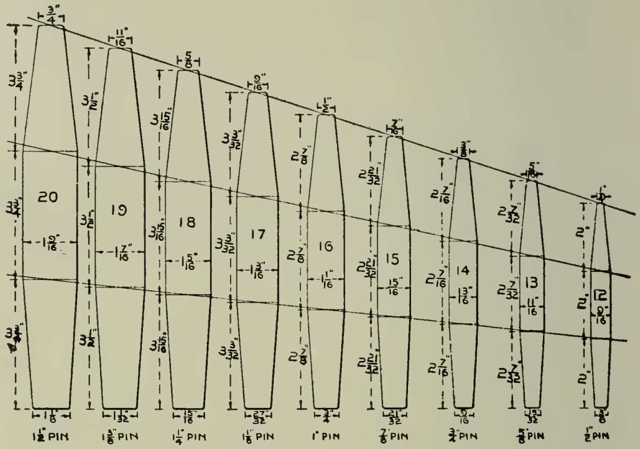




STANDARD DIMENSION OF GUIDE PINS AS RECOMMENDED BY THE COMMITTE.

No.	1	2	3	4	5	6	7	8	9	10	11
Diam. Rivet	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½
A	7/32	¼	7/16	9/16	⅝	¾	13/16	15/16	1 1/16	1 3/16	1¼
B	5/16	7/16	37/64	23/32	27/32	63/64	1 3/64	1 7/32	1 11/32	1 15/32	1 19/32
C	3/16	9/32	⅜	15/32	9/16	21/32	¾	27/32	15/16	1 1/32	1⅛
D	13/16	25/32	¾	23/32	11/16	21/32	⅝	19/32	9/16	17/32	½
E	1⅛	1 9/32	1½	1 21/32	1⅞	2 1/32	2¼	2 13/32	2 9/16	2 25/32	3
F	3 1/16	3 5/16	3 7/16	3 11/16	3 13/16	4 1/16	4 3/16	4 7/16	4⅝	4 13/16	5

With the improved drilling machines of today, which have reduced the cost of drilling and reaming holes to a minimum, it may be said that the old method of drifting holes in boilers, tanks and other plate work, to bring them fair, is a thing of the past; but still pins of some kind are an absolute necessity for holding plates in their proper places and for fitting up work. Guide pins are to be used judiciously and for the express purpose of fitting up work, and to be used as guide pins to keep plates in line while being bolted fast or while driving tack rivets, in order that work may be held in perfect line, and, as bolts are always smaller than the holes themselves, it is practically impossible to hold plates, with bolts commonly used, absolutely straight and in line with one another; hence guide pins become a necessary article for this work, but are not to be used in any case to drift holes to bring them fair after any part of the seam, which is being worked, has been riveted.



STRUCTURAL PINS.

Two classes of pins are recommended by your Committee. These shall be known in the future as guide and structural pins, and are shown in detail in the accompanying sketches.

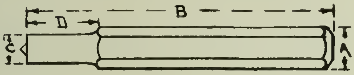
Guide pins are made with very little taper. The body is 1-32 inch larger than the diameter of the hole in which they are to be used.

Structural pins are to be used for structural work, as well as to be used for holding purposes in plate work. These pins are made with double tapered ends and have a body or straight part in the centers, of the same diameter as that of the rivet hole, so that where these are used for holding purposes they can be driven through the hole and allowed to fall on the opposite side without the necessity of having to hit the pin sideways or back it out.

This style of pin is recommended for guide purposes when work is to be driven on a hydraulic riveter or on work where the holder-on is in full view of the workman, so that there would not be any danger of driving the pin through the hole and in any way injure the holder-on.

Your committee, after giving this matter due consideration, presents both styles of pins for your approval, in the hope that they may be adopted and that the dimensions, as well as the pins themselves, will be found beneficial to all those who may have use for such tools. As they now appear, they have met the approval of the committee, and we hope that their dimensions will also meet with the approval of the members at the Convention, and that the work of your Committee will not only be accepted but that it will be appreciated as well.

MARKING TOOLS.



PROPOSED MARKING PUNCHES

INTERNATIONAL STANDARD

DIAM. RIVET	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1	1 1/8
NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	7/8	7/8	1	1	1 1/8	1 1/4
B	4 3/4	4 7/8	5	5 1/8	5 1/4	5 3/8	5 1/2	5 5/8	5 3/4	5 7/8	6	6 1/8	6 1/4	6 3/8
C	17/64	21/64	25/64	29/64	35/64	39/64	43/64	47/64	51/64	55/64	59/64	63/64	1 3/64	1 11/64
D	1/2	5/16	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8

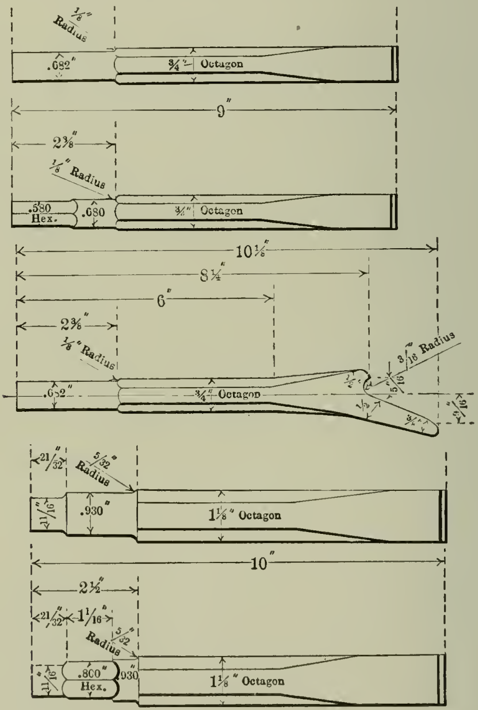
We present herewith detailed dimensions of marking punches, and in preparing this list we have assumed that holes for rivets will be punched or drilled 1-32 inch larger than the rivet, up to and including 7-16 inch above this size, 1-16 inch larger than the rivet to be used. Hence, we have prepared the diameter of the punch end 1-64 inch smaller than the size of the hole they are intended to be used in and recommend same for your approval and adoption.

PNEUMATIC TOOLS.

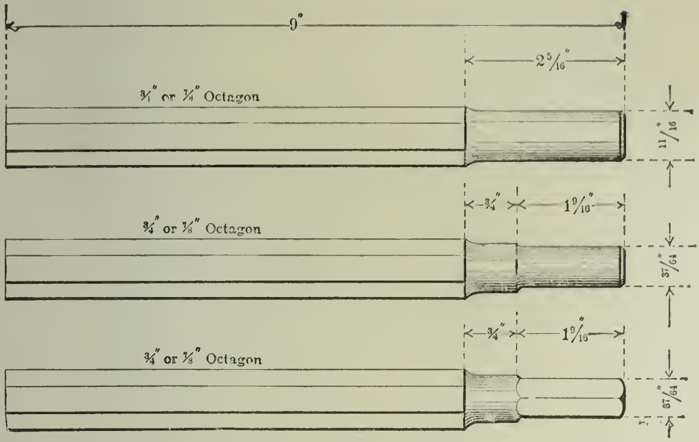
There is little to be said upon the subject of pneumatic tools concerning the matter of compiling the information, which leads up to the recommendation of the Committee, as these specialties have been pretty well standardized by the manufacturers of such tools themselves. This is a matter which has almost adjusted itself, evidently due to the fact that so much annoyance has been experienced in the early days of pneumatic hammers failing to work satisfactorily because of the fact that the operator would occasionally attempt to use a tool intended for another make of hammer, in which case the shank would be, say, ⅛ inch longer or shorter than the tool which was intended for use in the particular hammer in question. This would result in the failure of the tool to work satisfactorily and cause the tool manufacturers wasted time and a great amount of trouble. The constant annoyance to the manufacturers arising from this very point alone has been the means of most pneumatic tool companies realizing that it was absolutely essential that pneumatic tool shanks be standardized.

We, therefore, submit for your consideration cuts and dimensions of the various pneumatic tools, such as chisels, calking and beading tools, which we have found upon investigation to be practically those in vogue at the present time and which we are recommending for adoption.

PROPOSED INTERNATIONAL MASTER BOILER MAKERS' STANDARD PNEUMATIC TOOLS.



FINISHED TOOLS.

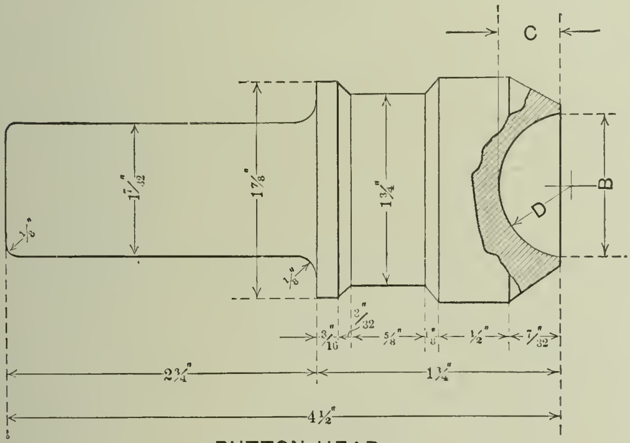


BLANK CHISEL SHANKS.

PNEUMATIC RIVET SETS.

We present herewith a table of dimensions, together with cuts of rivet sets, which are almost universally used among boiler

PROPOSED INTERNATIONAL MASTER BOILER MAKERS' STANDARD PNEUMATIC RIVET SETS.



BUTTON HEAD.

FORMULAE.

Area of Rivet × 2.5 = Area of Set B
Diameter of Set B × .4 = Depth of Set C
The nearest fraction being assumed.

The Length of Rivet = $\frac{45}{100}$ of the Diameter of the Head.

Diameter of Rivet	B	C	D
3/8 in.	19/32 in.	15/64 in	5/16 in.
7/16 "	11/16 "	9/32 "	23/64 "
1/2 "	25/32 "	5/16 "	13/32 "
9/16 "	7/8 "	11/32 "	29/64 "
5/8 "	1 "	13/32 "	33/64 "
11/16 "	1 3/32 "	7/16 "	9/16 "
3/4 "	1 3/16 "	31/64 "	39/64 "
13/16 "	1 9/32 "	33/64 "	21/32 "
7/8 "	1 3/8 "	35/64 "	45/64 "
15/16 "	1 15/32 "	19/32 "	3/4 "
1 "	1 19/32 "	41/64 "	13/16 "
1 1/8 "	1 3/4 "	45/64 "	57/64 "
1 1/4 "	2 "	51/64 "	1 1/32 "
"	"	"	"
1 1/2 "	2 3/8 "	61/64 "	1 7/32 "

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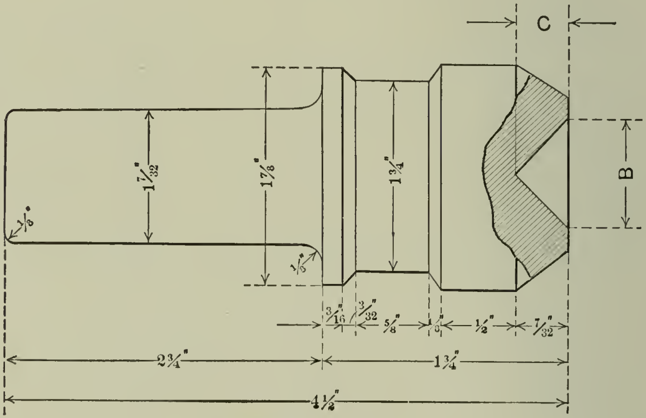
makers and bridge builders, and practically represent a standard among builders of this class of tools. The same trouble, which led to standard sizes of shanks for the smaller-sized tools is undoubtedly responsible for many of the manufacturers adopting



STEEPLE HEAD.

FORMULAE.

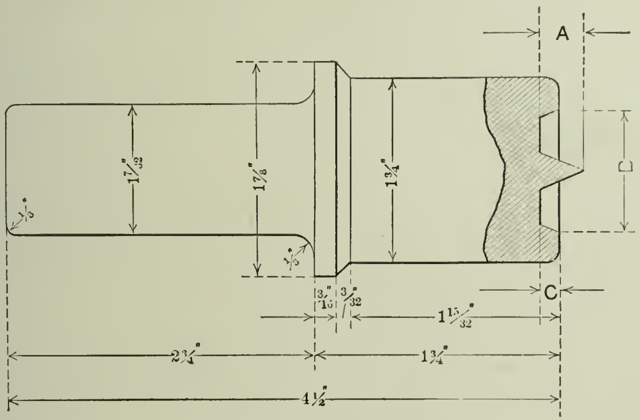
Area of rivet × 3 = Area of Set B

$$\text{Dia. of Set B} \times \frac{43}{100} = \text{Depth of Set C}$$

The nearest fraction being assumed.

D	B	C	D	B	C
3/8 in.	21/32 in.	9/32 in	7/8 in.	1 17/32 in.	21/32 in
7/16 "	3/4 "	21/64 "	15/16 "	1 5/8 "	45/64 "
1/2 "	7/8 "	23/64 "	1 "	1 23/32 "	47/64 "
5/8 "	1 3/32 "	15/32 "	1 1/16 "	1 27/32 "	51/64 "
11/16 "	1 3/16 "	33/64 "	1 1/8 "	1 15/16 "	53/64 "
3/4 "	1 5/16 "	9/16 "	1 1/4 "	2 5/32 "	59/64 "
13/16 "	1 13/32 "	5/8 "			

one size shank for rivet sets, and, since it is essential that the tools be standardized in all details, we take pleasure in recommending to the convention the adoption of the dimensions shown in the accompanying table.



STAY-BOLT HEAD.

Rivet sets correspond to the formulae adopted by the American Boiler Manufacturers' Association.

The foregoing report is respectfully submitted for your consideration and if our recommendations are accepted and adopted by the Association your Committee, and we judge the members as well, will watch with great interest the spirit with which they are accepted by the manufacturers, and the effort made by them to have same universally adopted by the punch users.

We hope that the time will soon arrive when we can look back upon the work we have done, in compiling this information, with pride, and when universally adopted by the punch users we will feel highly gratified and rewarded for our labor, and that your president, officers and members will have no cause to regret that they have placed their trust in men who have labored diligently in the interest of both the members and the punch users, who must necessarily be benefited by the adoption of these standards.

In conclusion, we most respectfully submit the contents of this report for adoption.

Respectfully submitted.

J. H. FAHEY, Chairman,
T. C. BEST,
O. C. VOSS,
WM. SHOEMAKER,
WM. HORSLEY,
J. H. SMYTHE.

Mr.Smythe: This is rather an elaborate report and I for one appreciate the work that the Committee has done. My name is on this, but I do not live in Chicago and therefore I could not meet with the members, but I had correspondence with them. I asked some questions as to whether it would be right that we should enter into this, and I found out by correspondence with the Committee, and also with the manufacturers, that it was just what they wanted us to do. It seems that they have a large amount of money invested in a lot of tools, where if they could be made standard it would be a saving to them, and it would also be a quick way of getting your tools, so therefore, if I am in order, I move that we accept this report.

The Chairman: That we adopt the standards?

Mr. Smythe: No, wait until I get through: that we accept this report and recommend to the manufacturers the adoption of this system.

The President: I do not believe it is necessary to go into this matter any deeper, as I have carefully studied it up, and gone over it. I have had it in blue print form, have checked it up, and called the Chairman or Acting Chairman in twice to take up certain things that I was not positive about. After going over it carefully, I believe it is a very good thing. Now we all know, as boiler makers, what confusion we have in order to get the right punches, especially the men of contract shops. No one who has not been into this can realize the proposition with which the Committee had to deal. Every manufacturer had a different make of punch. The Committee has brought about something that is standard. You can take it by number and get the right punch. If the manufacturers will take this up and adopt it as the standard, there will be no trouble in the future. It will not only be a benefit to us but more so to the manufacturers. I know personally that the members of this committee has sacrificed pretty nearly ever leisure hour during the last eight or nine months, and I know the Association appreciates this. Has Mr. Smythe's motion a second?

Mr. Laughridge: I second it.

Mr. Smythe: To save time, I would like to add that the committee be tendered a vote of thanks and discharged.

The President: The motion that the committee's report on standardizing of shop tools and equipment be accepted, that manufacturers be asked to adopt its recommendations as a standard, and the Committee be discharged with thanks. Is that the motion, Mr. Smythe?

Mr. Smythe: That is the motion.

The President: Any further remarks?

Mr. Best: A standard of any kind has never in the history of the world come from the manufacturer. It must necessarily come from an Association. As I said a few moments ago, I took the matter up—the matter of publishing this report—with our company. I also requested them to publish in our monthly journal standard flanges, which they did, for the benefit of the Association, and on some of the pages of this book I hold in my hand will be found the tables of standard flanges. You gentlemen will realize the fact that if we had not published this ourselves we would not have the necessary data at this convention to guide us. About the year 1892 the American Society of Mechanical Engineers took up the matter of standard flanges, and for several years a Committee worked faithfully to figure out a set of rules or measurements that would correspond with—

Mr. Smythe: I rise to a point of order. Mr. Best has wandered from the subject.

The President: Kindly confine yourself to the subject as near as possible.

Mr. Best: Later that Association, in spite of the fact that every manufacturing concern in the country that was in the fitting business fought them, is today using the standard that was adopted by the American Society of Mechanical Engineers at that time.

The President: Mr. Lowe, what do you wish to say?

Mr. Lowe: I have a few remarks to make in connection with the matter of pneumatic rivet sets as shown on this paper. We have found that the shank of the rivet set breaks off next to the shoulder, and to overcome that trouble we have counterbored the bottom section of the set, and made the shank an independent piece; that is, that it works in a piston-like action in the die, and we have overcome all the trouble of breaking off of the shank. I am just mentioning this as a suggestion for a change, which does not interfere at all with the standard form of the set.

A vote was taken, and some of the members voting aye and some nay, the president did not declare the result.

The President: I will explain the motion once more. It is that the Committee's report on standardizing shop tools and equipment be accepted, that this Association recommend to manufacturers they adopt it as standard, and that the committee be discharged with the thanks of the Association.

Mr. Lucas: I believe in common with a majority of the members that this report is a good one, but there are some things in it that when I go home we will not put into use; for instance, the rivet staybolt head. They have changed the contour to a flat head. We will not change our methods.

The President: What part of the report is that?

Mr. Lucas: On the last page of this pamphlet they have made a design which we are not using at the present time, and undoubtedly we will not change our methods. If the manufacturers adopt it, they will be sending them to us in that form. There are other things in the report that will conflict with our ideas and that we will never put into use.

Mr. Best: Mr. President and Gentlemen: The gentleman is laboring under a wrong impression, as no measurements are given at the bottom of that cut. There is no measurement given, only the outside dimensions. In fact, there is no measurement given at the point in question.

Mr. Lucas: Mr. President; I am not calling your attention to measurements. I am calling your attention to the design and shape of the staybolt head we will have hereafter.

Mr. Smythe: Mr. President, this subject was assigned to me. I recommended that we recommend for adoption the Chicago pneumatic tool standard. My recommendation, however, was changed. As the gentleman says, there are many things in the report with which we will not be in accord, but if we take up all of them we will be here until this time next week. I suggest this: we are all interested in it, and we know the manufacturers are. When we get home we can read and reread this report, and we can take interest enough in it to write to the manufacturers and tell them our ideas. They will not adopt this as we recommend it, but they would like to have an expression from this Association. I do not object to that, because I have made up my mind that when I go home I will write to some of the leading manufacturers of sets and give them my views. In that way I think we could help them. That is all we want to do to help them get a standard.

Mr. Rearick: I think the punches, dies and couplings were all that were mentioned. I don't think the members realize that they are voting on all that is incorporated in this report. I voted on that part of the report pertaining to punches, dies and couplings. I think it should be voted on carefully. There are many things in the report that we ought to consider, although we have not the time to take them up seviatim, but I would like to have a division called for, and let some explanation be made.

Mr. Flavin: Mr. President, I believe that we voted a little too hasty. I believe these staybolt sets will tend to shear the staybolt it is applied to. As a body of practical boiler makers, we cannot afford to go on record as recommending that. I don't know why these measurements were taken. This may mean an expenditure of thousands of dollars to the tool companies. I would move as a substitution for all motions that only so much of the report as pertains to standard couplings, dies and punches be adopted.

Mr. Best: I desire to say for the benefit of Mr. Flavin that we have not adopted the shape of the end of this tool at all. Our recommendations are for the shank only.

Mr. Flavin: Another point: that shank may cost the entire reproduction of the whole set of automatic machines for tools, and this is evidently taken from some tool of some description. Therefore, if it is adopted, it will mean a great expense to tool makers of other descriptions, and would therefore be unfair. But as far as the punches, dies and couplings are concerned, it is all right. As far as the tool companies are concerned, their work has been as close to standard as they could get it without destroying their pattern. There is but one tool company now that has not standard shanks. They are gradually working towards a standard. But as far as adopting a shank that would imply the destruction of all the patterns and blue prints and machinery of the different companies, I think it would be wrong, and I think we are going too far. All tool companies are working with us and taking an interest in our Association.

Mr. Best: I will ask if these measurements do not correspond with the tools you are handling?

Mr. Flavin: That would be out of order. I am not talking about my tools any more than any other. I am talking about all the companies.

Mr. Goodwin: It seems to me that we have this report before the Convention in such shape that many of the members do not fully understand it. With all due respect to the Committee—I know they have labored very hard and deserve a great deal of credit—but it does not seem to me it would be wise for this

Convention to put in any recommendations for the standardizing of any tools that would put anybody out of business. I don't think it is the intention of our Association to do so. It would be well for us to look into this matter wisely before we take such action. We should not do anything likely to convey the impression that we are working for any particular manufacturer (applause) or any particular concern. We have our friends throughout the country here, and we want them to know that we recognize them. We should go very slowly in adopting measures that would be a detriment to ourselves as an Association. (Applause.)

Mr. Troy: I understand this report has been adopted by the Association.

The Chairman: A vote has been taken.

Mr. Troy: I move that we reconsider the question.

Mr. Flavin: I second it.

Mr. Smythe: Gentlemen, you misunderstood me. I do not care which way you vote. If we vote to disagree, it is no disgrace to us. The supply-men or manufacturers have not agreed on anything in all these years. This is simply a recommendation to them. My idea was to put it before the house and dispose of it. I did not care which way you voted.

The President: We are only recommending this to the manufacturers for adoption. That still leaves the field open, and they can come back and say "Here is something we don't approve of; we would rather see it changed to measure so-and-so." We cannot force anybody to adopt this as a standard. I believe that the punches, dies and couplings would be all right. We can make this recommendation and let them go on with it, but the other subjects we can cut out or give the committee another year if you wish.

Mr. C. L. Wilson: As I understand the proposition, it is only a recommendation, and we take up all these matters from year to year. Now we may recommend a standard of some kind here. We may see in a short time that it is not right and we may want to change it ourselves. We are not putting this up as a permanent affair, and saying it has got to be so. I say either let the same committee act or appoint another committee, and let it run on for another year. We can adopt it as a recommendation to the manufacturers, and also give the manufacturers the names of the committee on standardizing which are to work during the next year; then, if any recommendations are made that are more suitable, we can improve on these. Tools may be proposed that are all right now, but they are improved from year to year. We are not expecting to go to some manufacturer and say, "Here, we are going to have this and nothing else." Let us take it up with the manufacturers and allow them to work out the problem with the committee. Suppose it takes two, or three, or four or five years, as Mr. Smythe says; the other people have been working on it for years and accomplished nothing. We cannot expect to have it all in one year.

Mr. Rearick: Is there a motion before the house now? Is there a motion to reconsider?

Mr. Lucas: Mr. President and Members of the Association, if we adopt one part of this now we adopt it all. We cannot take just dies, couplings and punches. We will have to take it all and send it out as our recommendations broadcast throughout this country. I don't think we ought to do it. I want you to think about it.

Mr. Kelly: Mr. Chairman and gentlemen, I believe there are a great many items in the report that we ought to adopt. If we buy a new machine we get a different style nut and a different style punch, and we have to throw these nuts and punches into the scrapheap. On the punch and die question I think we ought to get down to some standard and not keep going from one Convention to the other without doing so. It is to our interest just as much as it is to that of the manufacturer. Every boiler maker in getting a new machine has found that the punches and dies are of different threads or different shapes and as they would not fit had to go to the scrap pile. On the other hand, much of the report is wrong. Take what Brother Lucas says about the shape of that die. He is correct. As soon as we adopt that, those dies will come to us duly tempered. We will have to re-temper and shape them to suit ourselves. If you go to your superintendent of shops and say anything, he will say, "Why, gentlemen, there is what you adopted. What's the matter with you fellows?" Some parts of the report are wrong and some parts are right. We should adopt, I believe, punches and shanks for pneumatic tools, both riveting hammers and chipping hammers. If you have five or six different hammers you require the same number of different tools. I think we should have some of these standards, as they are a benefit to the railroad companies, but many are wrong and will simply go to the scrap pile if we do not watch what we are doing. I agree with Mr. Lucas, we ought not to be too hasty.

Mr. Goodwin: Mr. President, I think the point is well taken by Mr. Kelly with reference to the punches and dies. I am one of the members of the Association who don't want to close the avenue of thought with a report or statement advocating certain tools that will shut us out in the future. It seems to me the proper thing for us to do is to receive this report. Then we can add to it or change it in the future as we think best, but there is no use making anything in this report a standard or adopting it. Is there a motion before the house?

The President: There is a motion before the house.

Mr. Goodwin: I would offer as a substitute to that motion that we receive the report and express the thanks of the Association to the Committee for making so valuable a report.

Mr. Smythe: I second it.

Mr. Rearick: There is a motion before the house to reconsider. Mr. Goodwin is out of order.

The President: The first motion was never decided.

Mr. Rearick: There was a motion to reconsider and that motion was not considered. We are debating on it now.

The President: A motion for reconsideration will not be necessary for the first motion was not decided.

Mr. Troy: I will withdraw the motion to reconsider because the vote on the preceding motion was not declared.

Mr. Smythe: I withdraw my motion.

Mr. Troy: I second Mr. Goodwin's substitute.

Mr. Wagstaff: Mr. Chairman and gentlemen: I think we are altogether twisted on this paper. If you will remember, a year ago you voted that there should be several standing committees to report on this Convention annually. As I take it this report that has been presented on standard tools this morning is one of the reports of such a Committee. I would suggest, if I be in order, that this paper be turned over to a Committee and that Committee bring before this convention such items of this report as they deem it advisable for this Convention to approve. It never entered my mind that any of these standardizing committee papers would be accepted without revision but just put together in such a manner that we could understand them; and it seems to me we ought to accept the report, refer it to a committee and let the Committee report to the Convention later on.

The President: I would like to put the motion, gentlemen, and then you can talk. Has this motion a second?

Mr. Troy: The motion of Mr. Goodwin has been seconded.

The President: It has been moved and seconded that the report of the Committee on Standardizing Tools and Equipment be accepted and the Committee be given a vote of thanks for its able piece of work. Is that the motion?

Mr. Goodwin: That is the motion.

Mr. Brown: I am of the opinion that this ought not to be acted on too hastily. It would be favorable to me, as has been stated here, that this report be accepted and the Committee cordially thanked. Defer action pending a consideration with the different manufacturers. Then we will get something that this body can work on. I think it would be hasty indeed for us to adopt the suggestions offered. The Committee is perpetual. We can have amendments made or additions or improvements to this in a year.

Mr. Best: It would seem that the gentleman has not read the report of the Committee. I have in my room a great bundle of letters from the punch and shear manufacturers and do not think we have been hasty in this matter at all in making our recommendations. We have been ten months in correspondence with them. Some of the members here are of the opinion that we must accept the entire report. Nothing of the kind. We can vote on couplings, dies and punches, and drop it there, and then take up the next subject. You can vote on pneumatic tools or any portion of the report. It is not necessary to adopt the report as a whole. The Committee expected you to take up each subject separately.

The President: There is a motion before the house that this report be accepted with a vote of thanks to the Committee.

The President: What do you wish to do with this Committee, extend for another year?

Mr. Wilson: I move that this Committee be extended for another year.

The motion was seconded by several members.

Mr. Gray: I would amend that motion so that a Committee will be appointed on this paper to report before the Convention as to their recommendations for the addoption of part or all of it.

Mr. Best: I second the motion.

The President: The same Committee?

Mr. Gray: Appoint any Committee you wish.

The President: The motion before the house is that a Committee be appointed to check up and look over the report made to the Committee, make recommendations before the close of this Convention as to whether the whole of the report or part of it shall be adopted and whether they, this Committee, shall be extended for another year.

Mr. Best: They will not serve for another year. You cannot get it extended.

The question was put by the chair and the motion carried unanimously.

The President: On this Committee, I will appoint Mr. Best—

Mr. Smythe: I take exception to that. He has worked all the year. Mr. Lucas and some of these gentlemen have right ideas on this and they ought to be appointed. I don't think it is right to put on members of the old Committee.

The President: Mr. Kelly, Mr. Lucas and Mr. Flavin.

Mr. Flavin: Mr. President, I suggest that you appoint somebody else in my place. Of course, I am in the tool business and it might not look right.

The President: Mr. Kelly, Mr. Lucas and Mr. Ratterman will please serve on the Committee.

The President: The next order of business is the report of the Committee on the Standardizing of Pipe Flanges. Mr. Crombie of Hamilton, Ontario, is Chairman of this Committee.

REPORT OF COMMITTEE ON STANDARDIZING PIPE FLANGES.

The subject of a universal standard flange list that would be reliable and would not be hard on the Manufacturers with their numerous patterns, a standard that would be acceptable to the different Boards of Boiler Rules and Boiler Insurance Companies, is a subject that has occupied the attention of Engineering Societies throughout the world. Today we are called upon to look back over the work that has been accomplished along these lines and compare several of the standards in general use today.

Experiments have been conducted at various times to prove the strength of flanged fittings and the result of these experiments has given to the Engineering world valuable data on which to base their calculations as to the strength of pipe flanges and the safe load they are able to sustain.

We will not be able to deal fully, within the scope of this paper, with the experiments that have been conducted at different times to prove the strength of flanged joints, and find out where failure would possibly occur, and thus make each link in the chain not only safe to withstand the required pressure, but safe against abnormal conditions such as vibration, water hammer, or the careless opening of a stop valve under a heavy head of steam. Professor Thurston has shown by experiment that the pressure due to water hammers may be ten times that which the pipe was expected to sustain in its regular work.

There are two recognized standards for pipe flanges in the United States and Canada. One for pressure up to 125 lbs. was adopted by a joint meeting of the American Society of Mechanical Engineers, The Master Steam Fitters' Association and the Manufacturers, and is known as the A. S. M. E. Standard.

The other, for pressure up to 250 lbs. was adopted at a meeting of the Manufacturers some eight years ago. I have left out the light flange list which is only for 50 lbs. pressure and in Fig. 1 present to you the sizes adopted by the A. S. M. E. These sizes I have put in what I believe to be the most convenient system, leaving out all data, such as depth of spigot, or size of fillet, leaving for your attention only the essential matters which are necessary for use to see and compare.

High pressure screw flanges are shown at Fig. 2. These differ from the A. S. M. E. standard in size of flange, diameter of pitch circle and size of bolts and are intended for pressure up to 250 lbs. At Figs. 3 and 4 we have the same flanges as to diameter and pitch circle but with a slight difference in the hub diameter, and thickness, as these are made of forged steel, whilst Figs. 1 and 2 are of Cast Iron or ferro steel.

For steam pressure these screwed flanges have their limitations as the U. S. Marine Rules will not allow a threaded joint over 5 inches diameter.

It is necessary to use some other form of joint than the screwed one. The flange may be bored out, heated and slipped on to the pipe and the end peened over, or the hub of the flange may be drilled and the flange rivetted to the pipe. Sometimes the flange is bored out large enough to make an easy fit on the pipe, the pipe is then flanged over, the ends of pipe forming the joint, the flange is thus free to move around and engage the bolt holes in any quarter, Figs. 5 and 6 show these flange lists.

At Fig. 7 we have the British Standard. You will observe that they have one diameter of flange and one diameter of bolt circle for each size of pipe. This must appeal to us, because in drilling only one jig would be required for each size of pipe, to take either high or low pressure. It will only be necessary to change the bushing in the jig to suit the size of drill. The flanges are increased in thickness for the higher pressures, and the bolt diameter is also increased. In each of the foregoing flange lists, the holes are pitched in multiples of four so that the flange may be turned to any quarter.

I wish to present for your consideration what is known as "The Lovekin Universal Standard," Fig. 8. This Standard was gotten out by Mr. T. D. Lovekin, Chief Engineer of the New York Shipbuilding Co., of Camden, N. J., and is the result of experiments to determine the best design of flange for marine work. Following are extracts from Mr. Lovekin's paper on this subject. "I went at the designing of this flange with as much pleasure as though I were designing an engine, and after having gathered together all the data I could, I almost concluded that this branch of Engineering had been left to the old and familiar method of "rule of thumb." Be it as it may, I cannot refrain from expressing the view that while prominent engineers have frequently taken this subject up, they have seldom given the matter serious thought, but in the case of a flange springing between bolts, or the bolts themselves being weak, have either said to the Draftsman, "Put another ⅛ inch on the thickness," or "Put the next size larger bolt in and I think you will avoid the trouble."

There seems to me there has been more talk on such items as multiples of four bolts being absolutely essential to any standard and the thought as to how this or that suggestion would affect the valve maker with his numerous patterns on hand, than as to how this whole matter was going to affect the engineer whether at sea or on shore.

There is no doubt in my mind but that the industrial establishments throughout our whole country are suffering from leaky joints in steam pipes, and spending thousands of dollars on various kinds of gaskets in order to remedy defects which are chiefly due to a lack of strength in the flanges themselves. While firmly believing in standards, the present time for the higher pressures, some of the best concerns in New York City today are ordering forged steel flanges of the same dimensions as the standard cast iron ones in use at the present time for large power plants, and they are ordering these ponderous steel flanges for safety only.

What we all want is a universal standard, but we will never have this so long as the Mechanical Engineers of the world adhere to the multiple of four bolts.

Continuing he speaks of the "bulky, yet weak flange list known as the Mechanical Engineers' Standard," which in most cases under my supervision has proven so inefficient in the number of bolts used as to often require the placing of additional bolts between these multiples of four after the work has been erected. Personally I do not believe that there is a shipbuilder or marine engineer in the United States who would support such a standard as is used in the general commercial work for pressure above 150 pounds. If this is correct, why then should we not all unite in one standard for the higher pressures? There is positively no good reason why we should not have that same factor of safety in our power house that we have in our ships.

Further, in my opinion any standard flange list should have the joints or flanges equal at least to the bursting strength of the pipe itself so that we could rest assured that in the case of water hammers and other shocks of a similar nature, we had at least done our best from an engineering standpoint.

These flanges (Fig. 8) have been designed very carefully with a view of overcoming all possible objection. They are designed for a pressure of 300 pounds, the same diameter of flange, diameter of pitch circle, and number of bolts, however, to be used on all pressures between 100 and 300 pounds, the intention being to use this proposed universal standard flange list as designed for pressure between 200 and 300 pounds, and then to modify the size of the bolts for pressures between 100 and 200 pounds on all pipes above four inches so that we would never use less than a ⅝-inch bolt within the range of sizes given. In all these designs I have kept the section where the bolt passes through, the same throughout. Knowing this section to be more in accordance with mechanical principles than the parallel section commonly employed, caused me to adopt this form, and I have had numerous samples made and tested so as to prove my statements. Furthermore, I might mention that in order to be certain as to what could be accomplished in the direction of expanded joints, I made several samples of steel pipe 20 inches diameter and ½-inch thick, and the work done was such that the Committee of Science and Arts of the Franklin Institute awarded me the Elliott Cresson Gold Medal for my work in this new field of engineering.

In all cases where expanded joints are made I am certain that if necessary we can burst the pipe without in any way affecting the expanded joint when properly made.

It is also absolutely impossible to have a leak between the flange and the pipe when so expanded, for I have made numerous tests wherein I have heated both the pipe and the flange red hot and then plunged the same in water and afterwards placed them under a test pressure of 5,000 pounds per square inch without any sign of leakage whatever. This will be apparent to all when it is considered that the ends of the pipes themselves form the joint and any additional clamping effect produced by the bolts has a tendency to pull the pipe closer to the flange in direct proportion to the angle of flare, the small shoulder at the end preventing the pipe being forced out of the flange.

The advantages sought in this flange list are as follows:

First. A uniform outside diameter of pipe flange for pressure between 100 and 300 pounds.

Second. A uniform pitch circle for bolting flanges together.

Third. A sufficient number of bolts to be equal in strength to the bursting pressure of the pipe.

Fourth. A flange section fully as strong as the bolt section in all cases so designed that the weight of same is reduced to a minimum.

Fifth. To have all bolts entirely outside of the gasket, thereby preventing troublesome leakage through bolt holes such as is often encountered.

Sixth. That the areas of the gaskets between flanges may be subjected to a uniform pressure per square inch in all cases by means of the number of bolts used, said total pressure on gaskets being in excess of the tendency to pull joints apart (due to the internal pressure in the pipe) without subjecting the bolts to a stress of over 5.000 pounds per square inch, under working pressure. This feature of the gasket is a very important one, and the design submitted requires the minimum amount of material that could be desired for such purpose, thus securing a great saving in the supply and renewal of these gaskets.

Seventh. The flange as shown may be used for either copper or steel pipe and can be made of steel or iron for copper pipe, when not subjected to corrosion, therefore eliminating the practice of brazing the copper pipe to the flange, which, from results shown is not a necessity but rather a source of danger. Where necessary or advisable to use brazing metal or bronze flanges, they may be of the same sectional area as the steel flanges shown, inasmuch as these steel flanges have been designed for steel pipe, and the same sections may be made of brazing metal for copper pipe, and bear practically the same relation as steel flanges for the steel pipe.

The following figures give the working stress on the bolts due to 300 pounds pressure over the entire area of pipe and gasket.

Diam. of Pine....	2 in.	4 in.	6 in.	8 in.	12 in.	14 in.	16 in.	18 in.	20 in.
Stress in Bolts:	2,850	4 210	4,540	4,560	5,540	5,220	6,050	5,350	6,000

All belts to be of good mild steel or best grade of wrought iron. steel of 60.000 tensile strength; iron 45,000 tensile strength have ample safety in all cases.

The foregoing flanges are for connecting the pipe line, or for connecting valve and pipe line, and cannot be attached to the boiler. Following are a few of the methods employed to form a steam outlet from the boiler.

The valve may be bolted direct to shell plate on large boilers, the spigot on valve flange engaging the hole in boiler shell.

Fig. 9 shows a list of steel pipe flanges for riveting direct to boiler shell; these flanges are threaded for pipe. I have provided the pitch circle and number of rivets required for ⅝, ¾ or ⅞-inch single rivetting.

Fig. 10 are extensively used in British marine practice, the pad as shown is rivetted to the shell of boiler, studs to take standard size flange are screwed in between the rivets. The flanged pad is for higher pressures.

The saddle shown is often employed and is made from steel plate.

At Figs. 11 and 12 we have a complete list of saddle nozzles for which we are indebted to the Crane Co., Chicago. Some years ago the Crane Company conducted a large number of destructive tests to prove for their own satisfaction the bursting point of their flanged fittings. Some 52 pieces were subjected to hydraulic pressure until they burst. These fittings were principally tees and ells, only one piece of pipe being tested. The test pieces averaged:

Ferro steel, 33,000 pounds and cast iron, 22,000 pounds tensile strength.

Using these destructive tests as a basis, they have formulated the following rule, which, when applied to flanged fittings can be used to determine the thickness of metal for a given pressure or the thickness of metal being known to determine the pressure required to burst the fitting.

Rule No. 1. Thickness of body being known to determine the bursting point:

$$\frac{T}{D} \times S = B$$

Rule No. 2.

$$\frac{B \times D}{S} = T$$

where T = thickness of metal.
D = Inside diameter. ....
S = 65 per cent of tensile strength up to 12 inches diameter, larger sizes us 60 per cent.
B = Bursting point.

For working pressure divide result by a factor of safety 4 to 8.

A comparison of the theoretical bursting point shown by the proposed rule and the actual results are as follows:

Size I. D. inches.	Body Metal.	Av. B.P. pounds per sq. in.	Lowest B. P. pounds per sq. in.	B. P. per rule pounds per sq. in.	Av. B. P.	Lowest Bursting Pressure.	B. P. per rule. pounds per sq. in.
6	3/4	2733	2500	2675	1687	1675	1787
8	13-16	2250	2100	2172	1350	1200	1450
10	15-16	2160	2000	2172	1306	1200	1340
12	1	2033	1800	1782	1380	1100	1291
13 1/4	1 1/8	1825	1750	1584		1100	1120
15 1/4	13-16	1700	1700	1467	1025	1000	976
17 1/4	1 1/4	1450	1300	1433		600	955
19 1/4	15-16	1275	1150	1348		750	899
23 1/4	1 1/2	1300	1300	1277		700	851

Ferro steel 33,000 T. S. (Extra Heavy Flanged Tees) Cast iron 22,000 T. S.

STANDARD CAST IRON TEES.

6	9-16	1600	1500	1340
8	⅝		1150	1116
10	¾		1100	1072
12	13-16	775	700	893
14	⅞		700	825
16	1		750	825

At Fig. 13 we have a list of sizes made by the Bigelow Co., New Haven, Conn.

Fig. 14 shows the style of saddle nozzle used in British practice; they are of forged steel and are cone-shaped; this allows of one diameter pitch circle for the rivets instead of an ellipse as in Figs. 11 and 12; the diameter of top flange is British standard. I might state here that this standard, of which I have presented to you a small part in Fig. 7, was gotten up by the Engineering Standards Committee, supported by The Institution of Civil Engineers, The Institution of Mechanical Engineers, The Institution of Naval Architects, The Iron and Steel Institute, and the Institution of Electrical Engineers.

Apart from these standards mentioned herein, many of the valve makers have standards of their own. I have tried to present to you the best that there is on this subject, and hope to have more in hand by the time we meet in Louisville, Ky.

Through the failure of all the members of this committee to serve, I regret being unable to bring any definite resolutions before you, but would suggest that a strong committee, working in conjunction with other associations interested, should work towards that goal: A Universal Standard Pipe Flange List.

Mr. Crombie: Mr. Chairman and Gentlemen: This paper has been printed and placed in your hands, and I think it will be folly to read it to the members. I think a Committee should be appointed to work upon this subject. We are indebted to Joseph Ryerson & Son for publishing part of it in their journal. We have given all the different standards that are in general use in regard to pipe flanges at the present date. It is too large a subject to handle now. I move that a Committee be appointed to work upon this for another year and bring something definite before this Association.

The motion was seconded.

Mr. Best: I think it would be unwise to extend the Committee another year because the American Society of Mechanical Engineers on July 18th, 1894, adopted the standard flanges, and standard drilling of same. Perhaps there are a number of new members here who do not quite understnd what standard flanges are. For their benefit I will explain that standard flanges are drilled in multiples of four so that a valve, a fitting, an angle valve or any other kind of valve, can be faced in any quarter. Until June 28th, 1901, the manufacturers fought the standard recommended by the A. M. S. E., but on June 28th, 1901, the manufacturers of this country adopted the standard as recommended and adopted by the American Society of Mechanical Engineers. This standard is now in existence, and I venture the assertion that every foreman boiler maker in the United States in contract shops has a copy of standard flanges before him and uses it upon all of his nozzles, flanges and everything requiring drilled flanges because the system is absolutely perfect, it is beyond criticism, and I see no reason why we should extend this Committee another year.

The President: For the last 12 or 15 years I have not been in contract shops. Previous to that time I had charge of contract shops myself. At that time I would order a set of flanges, the boiler would be laid out, the templates made, and the holes put in the straight sheets, and along come the flanges. When I come to put my templates on I found the holes would go right in the root of the flange, and there would be a difference in the flat part of the flange—there was a difference in the thickness of them, and so on. Every manufacturer made a different kind of flange. Since the adoption of the standard by the American Society of Mechanical Engineers I have had no experience in contract shops, and I could not say how this matter has been since. I wish Mr. Best would explain about steel flanges.

Mr. Best: Mr. President and Gentlemen: Forged steel flanges are entirely a different proposition. It was not intended that this Committee serve on forged steel flanges at all, because we usually have a standard. In all the monthly stock lists issued by the iron and steel merchants or by any concern handling forged steel flanges, the diameter of the flanges is always given. The idea is to adopt a standard flange so that anyone making or buying a nozzle for a boiler, a valve or fitting of any kind, even though it is a pipe fitting, the flange to receive the pipe, will be of a standard diameter and drilled standard.

Mr. Lucas: The statement has just been made that every contract foreman in the United States is perfectly acquainted with the standard flanges in use as given in this book, which I believe is true. Railway master boiler makers are also acquainted with these rules, and they get these books every month from the different manufacturers; but we cannot recommend them as our standard. We can recommend adopting the standard of the

American Society of Mechanical Engineers because it is not our standard at all.

Mr. Crombie: I think that there is a wrong impression about this paper. Its title is "Standard Pipe Flanges for Steam Boilers, Etc." What Mr. Best wishes us to adopt in the list here is for the pipe line, and is not for steam boilers. We may adopt this standard, but there are other things to be taken into consideration. I will withdraw my motion, and move that we adopt the standard of the A. S. M. E., as ours, that it be put in our Book of Rules, and a Committee be appointed to work upon the matters in connection with this. I have drawings here illustrating the flanges for boilers, for marine or land work. If you will look at the whole paper you will find that there is much information in it with reference to this subject. I have the cast iron, the ferro steel, wrought iron and forged steel flanges all worked up to the different standards. I think it would be foolish to discuss the matter entirely. We can adopt this part of it, and have the other parts put before a Committee to work on during the coming 12 months.

Mr. Best: Mr. President and Members: I move as an amendment to the motion, that the Association adopt the American Society of Mechanical Engineers' standard flanges, and that the Committee be continued for another year on wrought iron, steel and all boiler flanges and nozzles.

The President: The motion is that we adopt the American Society of Mechanical Engineers' standard pipe flange, the Committee on Boiler Flanges be extended for one year, and an addition of three to that Committee be appointed by the chair.

The motion was seconded by several members and a vote being taken, the motion was carried unanimously.

The President: Mr. Wheeling, Mr. Filcher and Mr. Newdyke will please act on that Committee.

The President: Next will be the report of the Committee on which is the long way of the sheet.

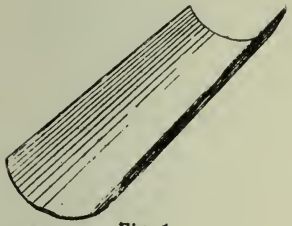
REPORT OF COMMITTEE ON WHICH IS THE LONG WAY OF THE SHEET.

Let us suppose that an order has been received in the shop for a certain number of sheets, 96 inches long by 48 inches wide, to be rolled to a radius of 60 inches. No sketch is enclosed with order, only the indefinite information to "roll sheets the long way."

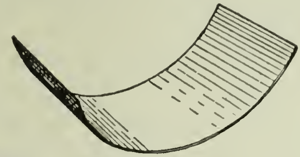
Much time could be taken up discussing whether the narrow or long side of a plate should be entered into the rolls when trying to fill this order.

It seems to be generally accepted in rolling boiler plate, that the proper way would be to enter the narrow end of the plate into the rolls and thus curve the long edge of the plate.

In the Sheet Iron Department, the opposite result would follow, the sheet being entered into the rolls the long edge of the sheet to the length of the rolls.



Short way Fig. 1.



Long Way Fig. 2.

We believe that the standard for our Association should be according to Fig. 2 in the sketch, or stated definitely, as follows. (That in a sheet of 96"x48" rolled to 60" radius, the 48" end of the sheet should be entered into the rolls, and the 96 inches of sheet, or the length of the sheet, should travel to the circumference of the rolls,) or stated simply (that the long edge of the plate or sheet be curved as per Fig. 2 when ordered to roll sheet the long way.)

Respectfully submitted,
Jas. Crombie, Chairman,
R. W. Hazzard,
Jas. Joyce,
Committee.

Mr. Crombie: This is short and sweet, but we could discuss it from morning until night. I move that the standard of our Association be according to the last clause in the report: that the long edge of the plate or sheet be curved, when the plate or sheet is ordered rolled the long way.

The President: My method of ordering a piece of shell or cylinder part of boiler outside of shop is to mention which part of it goes lengthwise of the boiler or tank, etc., as the case may be. We then know that it is to be rolled the opposite way, giving at the same time the diameter to which you wish it to be rolled.

Mr. Goodwin: I second the motion.

The President: The motion is that we adopt the report of the Committee, which is that the sheet lengthwise into the roll is the long way of the sheet.

A vote was taken and the motion carried unanimously.

Mr. Best: It might be put in a little different form because you generally receive an order by telegram or otherwise to ship one sheet 24x36, rolled the long way of the sheet to 44-inch diameter. There is going to be confusion unless made to read a little plainer.

Mr. Wheeling: I think the report itself explains what it means. I do not think we need to go any further on that subject.

The President: The report on boiler explosions is next in order. Mr. Goodwin is Chairman of the Committee.

Mr. Goodwin: I am satisfied that we will have no discussion upon the recommendation or the adoption of this report. Consequently I am satisfied that the only thing to be done is to have it read and accepted. I am very sorry indeed we could not issue it in printed form in advance of the Convention, but owing to our financial condition the Executive Committee thought it unwise to do so. Furthermore it could not be of any great service, except for reading and reference. As you are all aware, the question is one you cannot take up and treat very severely, except on technical lines. No one can be referred to as an example as none of us care to be advertised on those lines. The suggestions in its statements have been made up from authors, and from people who have had experience so that the Committee does not deserve much credit. They gave me all the information they could. "The Boiler Maker" magazine, in this month's issue, had some data that is included in this report as a matter of record for our Association. It was taken from "The Locomotive," issued by the Hartford Steam Boiler Insurance Society, I thought it was excellent information, and so have embodied it in the report.

REPORT OF COMMITTEE ON BOILER EXPLOSIONS.

The causes of boiler explosions are numerous, but it is seldom that the cause is not understood. When uncertainty exists, it is probably due to the fact that the case was not properly investigated. When this is done, the causes are usually found to be simple and well-known. When we reflect upon these, we are fully cognizant of the fact that much can be said that would be of vital interest to each one of us, on a subject that imposes a responsibility upon every one connected with this profession. We can realize what neglect on our part may mean in the destruction of property, and more than all, what a disaster an explosion may be, as to loss of life. If we give conscientious thought to our duty in personal inspection and examination, we will be convinced what part in this life we are playing today.

Your Committee feels that too much can not be said, in impressing upon your minds the importance of such work, and the necessity of using all the energy on hand, heart and brain, in endeavoring to reduce these calamities to a minimum. As has been said by a well-known author, the management of steam boilers, or more correctly, their mis-management, is the usual cause of explosions. A well-made boiler with good management and proper supervision may be considered practically free from danger.

Usually progressing decay by corrosion is the most common of all causes of explosions of steam boilers. A boiler designed and constructed of the best possible proportions, and of the best materials, having at the start a factor of safety of 4½ to 5, may be considered as safe against this kind of accident, but with its beginning, decay also begins, and the original margin of safety is constantly lessened by never-ceasing disintegration. The result is a reduction of this margin to that represented by the difference between the working pressure, and that fixed as a maximum by the inspector's tests. Professor Thurston says: "Theories of explosions, due to other causes than simple increases of steam pressure, or decrease in strength of boiler, are as various as they are interesting. The majority of all boiler explosions have been found to be due to causes which could have been readily detected, and which are the simplest and most obvious. Explosions have occurred which were so exceptionally violent, or which occurred under such unusual and singular conditions, as to give rise to the question whether some peculiar phenomenon is not concerned in the bringing about of so extraordinary results. It is found in nearly all explosions that either by a gradual rise in pressure the resisting power of the boiler has been exceeded, or that by a gradual reduction of the strength of the structure, until it is insufficient to withstand the allowed working pressure, and a general yielding leads to an explosion. Such cases require little comment and no explanation; but the rare instances in which a sudden development of force far in excess of those exhibited in regular working, have been believed to have been observed, and have given rise to much speculation, to many ingenious theories, and to an immense amount of misconception on the part of those who are unfamiliar with conditions and experience in the operation of boilers."

A common occurence that meets with your observation is low water, and this is considered, by experienced engineers, to be the most common, even the most invariable cause of explosions. This view is now refuted by some engineers, but it remains one of the undeniable sources of danger and causes of accidents. Says Thurston: "Its origin is usually some accidental interruptions of the supply of feed water. Whatever the cause, the result is the uncovering of those portions of the heating surfaces, and their exposure, unprotected by an efficient cooling agency, which causes the explosion."

Owing to diversified opinions of men of the boiler making profession, your attention is called to some experiences of Professor Thurston, in connection with low water, in which he says: "Every boiler-making establishment is continually collecting illustrations of the fact that a sheet may become overheated, and may even alter its form seriously, when overheated, without completely yielding to pressure." He says he has taken part in many attempts to experimentally produce explosions by pumping feed water into red hot boilers, and has but once seen a successful experiment. The same operation in the regular working of boilers has been often performed by ignorant or reckless attendants, without other disaster than injury to the boiler, but it has unquestionably, or other occasions, caused terrible loss of life and property. The raising of the safety valve on a boiler, in which the water is low, by producing a greater violence of ebullition in the water on all sides, the overheated part may throw a flood of solid water or a spray over it, and it is possible that this has been the cause of many explosions. He says he has seen but a single explosion produced in this way, although he has attempted to produce such a result. In three experiments on a certain cylindrical boiler, empty and heated to a red heat, the results of rapidly pumping in a large quantity of water, was, in the first, the production of a vacumn. In the second, an excess of pressure, safely and easily relieved by the safety valve, and in the third case, a violent explosion of the boiler and the complete destruction of the brickwork setting. The boiler experimented upon was set in brickwork in the usual manner. In each experiment, when the fire was in good order and the steam at the right point, all water was blown out; the boiler was allowed to become heated to the desired temperature, as indicated by a pyrometer, which was inserted within it, and at the proper moment the feed water was introduced by a force pump. On each occasion, on the introduction of the water, the steam pressure rose suddenly, the safety valve opened, and the water still continuing to enter, the boiler pressure dropped almost as rapidly as it had risen, and the boiler cooled each time (except the last) without apparent injury, and without even starting a seam, although the metal had been red hot. The last experiment resulted in the explosion of the boiler and the destruction of its setting. The temperature of the boiler on this occasion was higher, probably a bright red on the bottom; and the pressure of steam was about 60 pounds. Before the explosion occurred, it had fallen somewhat from the maximum attained the moment before.

A committee of the Franklin Institute, conducting similar experiments, had the same experience. Explosions due to low water, when there is considerable water below the level of the overheated metal, are sometimes fearfully violent. A boiler completely emptied of water and exploded by the volume of steam contained within it is far less dangerous. Low water and red hot metal in a locomotive or other firebox boilers are for this reason far more dangerous than a plain cylindrical boiler, as was indicated by experiments. The latter must be entirely deprived of water before this dangerous condition can arise. Experiments with apparatus devised for the purpose of keeping the steam moist under all circumstances, indicate that it is difficult, if not impossible, to overheat even an uncovered firebox crown sheet, if the steam be kept moist, and that such steam is very nearly as good a cooling medium, in such cases, as the water itself.

We invite your attention to the above quotations, which this eminent engineer has treated so clearly, for thought in your discussion and trust that your experience will give further light on this subject.

General decay creates vastly different degrees and elements of danger. Hence corrosion extending over considerable areas of plate, or along lines of considerable length, is a cause of danger, disruption and explosion. A corroded spot in firebox, a loosened rivet, or even a broken staybolt, if the boiler be otherwise well proportioned, well built and in good order, may not be a serious matter; but a thinned sheet in the shell, a long grove under the lap, a line of loose rivets, or a cluster of weakened stays or braces, are certainly most dangerous; general or widespread corrosion is very liable to lead to an explosion.

With all that has been said, your Committee is unable to ask your attention to any phrase of this subject that appears more interesting than the following tables 1, 2 and 3, which were compiled by the Hartford Steam Boiler Inspection and Insurance Company, of Hartford, Conn., and through the courtesy of this well-known company we invite your consideration, which includes all classes of boiler explosions, that they have on record, for a period of 41 years, in which we use their explanatory report that accompanies it in the January, 1909, issue of "The Locomotive."

TABLE NO. 1.

SUMMARY OF BOILER EXPLOSIONS FROM OCTOBER 1st, 1867, TO JANUARY 1st., 1909.

	Number of Boiler Explosions.	Number of Persons Killed.	Number of Persons Injured.	Total of Killed and Injured.
1867*	31	48	52	100
1868	101	226	185	411
1869	96	147	268	415
1870	109	213	272	485
1871	89	383	225	608
1872	98	232	235	467
1873	92	130	215	345
1874	96	175	160	335
1875	102	134	195	329
1876	75	147	145	292
1877	83	157	201	358
1878	97	178	216	394
1879	132	208	213	421
1880	170	259	555	814
1881	159	251	313	564
1882	172	271	359	630
1883	184	263	412	675
1884	152	254	251	505
1885	155	220	278	498
1886	185	254	314	568
1887	198	264	388	652
1888	246	331	505	836
1889	180	304	433	737
1890	226	244	351	595
1891	257	263	371	634
1892	269	298	442	740
1893	316	327	385	712
1894	362	331	472	803
1895	355	374	519	893
1896	346	382	529	911
1897	369	398	528	926
1898	383	324	527	901
1899	383	298	456	754
1900	373	268	520	788
1901	423	312	646	958
1902	391	304	529	833
1903	383	293	522	815
1904	391	220	394	614
1905	450	383	585	968
1906	431	235	467	702
1907	471	300	420	720
1908	470	281	531	812
Total	10,051	10,884	15,634	26,518

*Last three months of year.

TEN THOUSAND BOILER EXPLOSIONS.

"As readers of *The Locomotive* are well aware, we have made a practice, for many years, of recording, in this journal, the boiler explosions that occur in the United States, and in the adjacent parts of Canada and Mexico; and each year we also publish a summary of explosions of the year preceding, giving the number of such explosions, and the number of persons killed and injured by them. We began keeping these statistics on October 1, 1877, so that they now cover a period of over 41 years; and it is both instructive and impressive to look back over this record.

"As will be seen by Table 1, the total number of boiler explosions recorded, and briefly described in these pages, up to and including the present issue, is no less than 10,051. These have resulted in the death, either immediately or within a few days, of 10,884 persons, and in the more or less serious injury of 15,634 others, so that the total number of persons killed and injured by the explosions that have been recorded in *The Locomotive* is 26,518. These figures are worth more than passing attention, and we commend them particularly to those persons (for there still are such) who believe that boilers do not explode, or that they explode only rarely.

"In preparing Table 1, we have revised all of the lists of explosions that have been published during the period that it covers; and we have made out new summaries for the years previous to 1879, not only for the purpose of detecting any errors that previous summaries may have contained, but also with the additional object of securing uniformity in the method of summarizing. In the early days, for example, explosions occuring in England, Germany, France and other distant parts of the world, were recorded and used in the annual summaries, if they were of a serious character, but in later years we have omitted such explosions from our regular lists, mention of them, when mention has been given, being confined to separate paragraphs or articles. In preparing the tables given in the present article, foreign explosions have been omitted altogether, except (as noted above) those occurring near our borders, in Canada or in Mexico.

"In looking over the accounts of boiler explosions, we often find it said that 'several' persons were injured; and for the purpose of summarizing the explosions during a given period it is necessary to estimate the probable number that the word 'several' signifies, when so employed. Some years ago we undertook to settle this point as definitely and fairly as possible, by studying those cases in which some of the accounts of a given explosion said 'several' persons were injured, while other accounts of the same explosion gave the exact number, and we found that the average number of persons injured, when the account says 'several' appears to be exactly three. In recent years we have therefore assumed that 'several' means 'three', when used in this way, and this interpretation has been given to it, in the earlier years, as well as in the later ones, in making out the present revised summary of the explosions since 1867.

"From the data given, it can be figured, that for the whole period of over 41 years, the average number of persons killed per explosion was 1,083, while the average number of persons injured (but not killed) per explosion was 1,555; the average number of persons that were either killed or injured, per explosions, being therefore 2,638.

"It is interesting to note the way in which the number of persons killed or injured, per explosions, has varied with the progress of time. This variation is shown very clearly in Table 2, in which the data given in the large table have been summarized for four successive ten-year periods, the average number of persons killed or injured, per explosion, being given separately for each period. If we take the average number of persons killed, or the average number of persons injured as an indication of the seriousness of an explosion, Table 2 indicates that the boiler explosions of this country have been growing less and less serious—the change in this respect being marked and continuous. No doubt the tendency here indicated is in part real, owing to the improvement that has taken place in design, construction, and operation of steam boilers. We are of the opinion, however, that this progressive diminution in seriousness is plainly illustrated by the last three columns of

TABLE NO. 2.—COMPARISON OF TEN-YEAR PERIODS.

Ten-year Period.	Total Number of Explosions.	Total Number of Persons Killed.	Total Number of Persons Injured.	Persons Killed Per Explosion.	Persons Injured Per Explosion	Persons Killed jured Per Persons In-
1868 to 1877*....	941	1944	2101	2.07	2.23	1.08
1878 to 1887*....	1604	2422	3299	1.51	2.06	1.36
1888 to 1897*....	2926	3252	4535	1.11	1.55	1.39
1898 to 1907*....	4079	2937	5116	0.72	1.25	1.74

*Inclusive, in each case.

"Table 2 is in a measure misleading, as is proven by the vast improvement that the forty years have brought in our facilities for obtaining information concerning explosions. The collection of these statistics began, for example, only twenty-three years after Morse's first experimental telegraphic line had been erected; and the early part of the table is therefore concerned with a period in which the telegraphic news service of the country was exceedingly imperfect, and in many sections almost non-existent. Moreover, the Hartford Steam Boiler Inspection and Insurance Company was a very small concern forty years ago; whereas it is now a vast organization, having almost everywhere representatives who are all the time looking for information concerning boiler explosions. Bearing these two facts in mind, it is natural to conclude that in the early part of the forty-year period the smaller explosions escaped their attention in a large measure, while the constantly increasing efficiency of the telegraphic news service, and the continued growth of this country would cause explosions of relatively smaller 'news value' to be noted and reported to the home office in later years, so that the average seriousness of an explosion would appear to diminish with the progress of time, even if there was no diminution in reality.

"We do not consider that the falling off in apparent seriousness has been due in any appreciable measure to the increasing use of sectional boilers, for our experience has indicated that the bursting or rupture of such boilers is all too frequently attended with serious consequences in the way of killing or injuring the attendants. Moreover, the falling off in seriousness dates from a time when the number of such boilers in service was altogether too small to have any considerable effect upon the statistics of the country as a whole; and, finally, even if there were any real tendency towards decrease in seriousness, due to the gradual adoption of sectional boilers, we believe that this would be more than counterbalanced by the simultaneous tendency that there has been towards higher steam pressures and the use of large boilers.

"We have often been asked whether boiler explosions occur with equal frequency at all times of the year, or whether there is any evidence that they happen oftener in some months than in others. The data required for answering this question is given in Table 3, where the explosions are classified according to months, for each period of 10 years. During the 10-year period, beginning with January, 1888, and ending with December 31, 1907, for example, there were 288 boiler explosions in the month of January, 269 in the month of February, 224 in the month of

March, and so on. In the sixth column a similar classification by months is given for the whole period of 40 years, extending from January 1, 1868, to December 31, 1907, and in the final column we give the number of explosions in each respective month, expressed as a percentage of the whole number of explosions that occurred during the 40 years.

"As might be expected, there is no very pronounced variation in the number of explosions from one month to another, but yet the frequency does depend to a certain extent upon the time of the year. It is evident that there is a sensible falling off in the number of explosions in April, May and June, and that there is a corresponding increase in the number in October, November, December and January. This change is partially due, no doubt, to the explosion of heating boilers in northern latitudes during the colder months. It cannot be entirely due to this cause, however, for there is a very decided falling off between January and February, notwithstanding the fact, that February is perhaps as cold as January, so that between these months there would be no material reduction in the number of heating boilers in service, nor in the duty required of those in use. Also, it is plain that the increase in the number of explosions begins in hot weather, the number of explosions in August being greater than the average number, per month for the whole year."

TABLE NO. 3 CLASSIFICATION OF BOILER EXPLOSIONS BY MONTHS SINCE 1868.

	Ten-Year Period					
Month.	1868 to 1877*	1878 to 1887*	1888 to 1897*	1898 to 1907*	Forty Years, 1868 to 1907*	Percentage of Explosions Per Month During 40-Yr. Period.
January	98	181	288	425	992	10.38
February ...	87	141	269	347	844	8.84
March	68	129	224	327	748	7.83
April	83	102	180	294	659	6.90
May	67	117	205	260	649	6.79
June	65	126	177	263	631	6.61
July	56	124	211	305	696	7.29
August	73	138	276	339	826	8.65
September ..	86	131	246	359	822	8.61
October	87	129	301	377	894	9.36
November ..	81	143	275	389	888	9.30
December ...	90	143	274	394	901	9.43
Totals ..	941	1604	2926	4079	9550	100.00

*Inclusive, in each case.

The following table, showing explosions of locomotive boilers during the years of 1897 to 1907 inclusive, together with number of killed and injured, was compiled from Poor's Manual, and information taken from *The Locomotive* of the Hartford Steam Boiler Inspection & Insurance Co., and other sources, and it is as near accurate as can be obtained from information at hand. We feel that some minor explosions may be overlooked, possibly in being reported, but would feel safe in saying that a locomotive explosion is more than likely to be recorded, owing to the prominence it has in press comments, and therefore, feel safe that the records are near the margin of accuracy.

TOTAL EXPLOSIONS OF LOCOMOTIVES.

1897	27
1898	27
1899	33
1900	17
1901	26
1902	43
1903	30
1904	38
1905	47
1906	44
1907	55

Year.	Engines in Service.	Explosions to which no definite Cause Is Assigned.	Explosions, per Cent	Increase of Explosions Over Previous Yr., Per Cent.	Decrease of Explosions Over Previous Yr., Per Cent.	Killed.	Injured.
1897	...36,410	20	.000549	......	......	23	23
1898	...36,746	21	.000571	.000022	......	25	25
1899	...37,245	30	.000805	.000234	......	39	43
1900	...38,065	13	.000342	......	.000463	7	29
1901	...39,729	19	.000478	.000136	......	24	22
1902	...41,626	35	.000841	.000363	......	45	39
1903	...44,429	23	.000517	......	.000324	19	56
1904	...47,844	32	.000669	.000152	......	28	52
1905	...49,616	41	.000826	.000157	......	52	89
1906	...55 439	38	.000685	......	.000141	30	66
1907	...58,301	51	.000874	.000189	......	77	85
						369	529

Year.	——Explosions Due to—— Crown Sheet Failures.	Collisions.	Derailments.	Flue Failure.	Killed.	Injured.
1897	3	4	0	0	16	20
1898	3	1	1	1	3	10
1899	2	1	0	0	1	3
1900	3	1	0	0	2	2
1901	3	2	1	1	8	20
1902	5	1	1	1	10	10
1903	5	2	0	0	6	9
1904	6	0	0	0	5	7
1905	2	3	0	1	2	5
1906	5	1	0	0	1	10
1907	4	0	0	0	1	5
Totals..	41	16	3	4	56	101

EXPLOSIONS DURING 1907.

Month	Explosions.	Killed.	Injured.
January	4	12	2
February	8	9	13
March	8	9	20
April	4	8	6
May	1	0	0
June	3	3	2
July	7	12	19
August	5	7	8
September	5	5	7
October	6	4	6
November	2	5	4
December	2	4	3
Totals	55	78	90

You will note the increase in the number of locomotive steam boiler explosions in 1907 over 1906, notwithstanding the fact, an increase of 2,862 locomotives in service in year of 1907 over previous year. The increase in explosions in percentage column shows .000189% over 1906, and as it shows, are more violent, as to the number of killed and injured, as indicated under their respective headings. This should lead you to consider the important question of factor of safety. When we fully realize the high pressures that are universally in use today, we can see the necessity of diligence on our part, in performing our duties, as to workmanship and thorough inspection, which are some of the safeguards to boiler explosions.

Respectfully submitted,

J. T. Goodwin,..
Chairman.

Mr. Laughridge: I do not think this Association could afford to discharge a committee that has done its work so ably. I move that the Committee be continued for another year and complimented for their past work, and that their report be received and placed in the proceedings as read.

The motion was seconded.

Mr. Wehling: For the benefit of the members of the Association I want to make a remark in connection with the report. I have compared the reports of the Imperial Statistical Bureau of the German Empire with the Hartford Steam Boiler Inspector's Report, and found that in the last 20 years we had in this country about an average of 300 explosions a year. The total number of boilers used over there is nearly the same as here as far as we can find out. We have no complete records here. I find that where we had an average of about 300 explosions per year for the last 20 years, they have had an averagee of seven per year, and it struck me very forcibly that something should be done in this country. I believe there should be the enactment of proper laws to compel proper inspection by competent men. In that country they have laws that cover every single boiler that is used. No matter where or for what purpose, it must be inspected. Such laws we do not have and I believe that is where we are lacking.

The President: It has been moved and seconded that we extend a vote of thanks to the Committee on Boiler Explosions for the very able report they have produced and that the Committee be continued for one more year.

The vote was taken and the motion carried unanimously.

Mr. Goodwin: I don't think it is exactly proper to continue the Committee. Of course I am at your service to do anything I can do. I don't want to hurt anybody's feelings, but I think we had better reconstruct that Committee. Some of the members have not said very much to me on the subject. The Committee is perfectly acceptable if I am going to be retained. I don't know that we have more eminent men in the profession than those gentlemen, but I want them to say, "Here, we are going to get up some data for you," and give me some data, because it is a hard proposition. It is not everybody that cares to go on record in these reports. We have to avoid touching anybody as near as possible, but it is necessary to bring out the facts. If the President is to appoint this Committee, I would like him to excuse me if possible; but if you do not care to do that, I would like you to talk to the other members and help me to induce them to do something along that line.

Mr. Best: I suggest that those who have been appointed on the Committee on Boiler Explosions and have absolutely done nothing, be replaced by others who will do something to aid this Committee.

The President: Gentlemen, Mr. Goodwin as Chairman of the Executive Board has had considerable on his hands in addition to this. I believe he was left to work alone on this report, and it certainly is not right. Members who are appointed on committees, if they do not wish to accept their appointment, should at least notify the President, and then he can appoint someone else.

Mr. Laughridge: It would be a good idea to have one man on each committee, if they brought in a report like that of Mr. Goodwin. I have no objection to his request being granted to select new members on his committee.

Mr. Goodwin: I think the proper thing to do is to appoint a new Committee. Your Committee on Boiler Explosions has served two years. If a new Committee is appointed, they will probably be able to get up different information than we have.

Mr. Laughridge: If it is Mr. Goodwin's wish, I will withdraw that part of the motion.

The President: The motion has been put before the house and carried.

Mr. Kelly: I think another Committee should be appointed. I think if we have a new Committee new ideas on boiler explosions will be brought out.

The President: Is there a motion to reconsider?

Mr. Wheeling: I move to reconsider previous action.

The President: It has been moved and seconded that we reconsider the vote on the motion to continue the Committee on Boiler Explosions for one year and that the present Committee be discharged with thanks.

A vote was taken and the motion carried unanimously.

The President: It devolves upon the newly elected officers to appoint a new Committee.

Mr. Brown: There has been presented to you this morning by the librarian, William F. Yust, of the Louisville Free Public Library, a key to the technical and mechanical department of the library. Each of you is entitled to a copy of this. It explains how you can get these books, how long you can keep them and how you are to return them. As I understand it, if you are in the Dominion of Canada and you are a member of this Association, you are entitled to any of the volumes contained in this book, with the understanding that after keeping them a reasonable time you will return them to the library. These pamphlets are given to you with the compliments of the Louisville Free Public Library. (Applause.)

Mr. Wheeling: I move that we extend a vote of thanks to the library management.

The motion was seconded and carried.

Mr. Goodwin: I move we adjourn until 9.30 o'clock to-morrow morning.

The motion was seconded and carried and the Convention adjourned until Thursday at 9.30 a. m.

THIRD DAY'S SESSION.

The Convention was called to order by the President at 9.30 a. m.

The President: The first order of business this morning is the report of the Committee on Best Method of Staying the Front Portion of Crown Sheet on Radial Top Boiler to Prevent Cracking of Flue Sheet in Top Flange. Henry Rapp of Waterloo, Iowa, is Chairman. Mr. Rapp, will you kindly make your report.

Mr. Rapp: I believe all the members have been furnished with a report and I move that the subject be open for discussion without reading the report.

The motion was seconded by several members.

Mr. Lucas: It would refresh our minds in general if we had the report read. I move that we have the report.

The motion was seconded by several members and carried.

REPORT OF COMMITTEE ON BRACING CROWN AND FLUE SHEETS.

Your Committee on the "Best Method of Staying the Front Portion of Crown Sheet, in Radial Type Boilers, to Prevent Cracking of Flue Sheet in Top Flanges," beg leave to make the following report:

Your Committee will take up first the causes of flue sheets cracking, then their repair, and in conclusion the best methods for their prevention.

In the smaller and medium size radial stayed locomotive boilers, with flue sheets from 34 inches to 38 inches wide, and having from 135 to 160 flues, which remain comparatively tight, cracks do not develop for from 5 to 7 years. In the wide fire box type of boiler, designed for from 180-pound to 210-pound maximum pressure, containing from 300 to 400 flues, which leak almost daily, the flue sheet will crack in from 1½ to 3 years.

When flues are reset considerable tension is put on the flue sheet, the sheet sometimes stretching from 3-32 inch to 3-16 inch, when heat is applied, the part in tension naturally moves toward the point of least resistance, i. e., the top of flue sheet; the almost daily working of the flues, whether with sectional expander, roller, calking tool or pin, tends to accellerate the movement. As a larger number of flues are worked along the vertical center of flue sheet than along the sides, it follows that the stretching of the sheet is greatest through the center; the continued expansion resulting in a cracked margin, near the center of upper flange, starting at a flue hole and often continuing through the roof of flange into a rivet hole. The narrower the margin above the flues, the greater will be the tendency to crack; likewise, all other conditions being equal, the deterioration of a flue sheet in a bad water district, where flue leakage is considerable, begins much earlier than in a good water district where leaky flues are the exception. The life of the former being from three to five years, of the latter from six to eight years.

On some railroad systems this expansion is so persistent, that on the removal of flue sheets, they have been found to be from ⅜ inch to 1 inch longer through the center than when applied.

The style of bracing at the front portion of the crown sheet does not seem either to add to or detract from the integrity of the flue sheet, or its ability to withstand successfully the strains put upon it.

There are three styles of bracing of about equal value. so far as the flue sheet is concerned; they are crown bars, eye bolts and tee bars, with sling trays attached. The two latter are more generally used.

On one of the large railroad systems over one hundred large size switch engines having radial stayed boilers, with two rows of sling stays next to flue sheet, have been in service from 1 to 17 years. The flue sheets in these engines are in good condition, with an almost perfect flange, due to the fact that the flues seldom leak, and therefore the sheets have not been stretched by working the flues. No flue sheets have been renewed in these engines up to date.

On this system are a large number of radial type boilers, a part of which have eye bolts and sling stays across the front end of crown sheet, the balance have the tee bar style of bracing. Under favorable conditions the flue sheets in these engines last from five to fifteen years; where opposite conditions exist, they last from three to five years, the top flange often being bent down from 1 inch to 1¼ inch, and the sheet cracked from a number of the top flue holes to the rivet holes.

In regard to their effect on the flue sheet, there was no advantage found in either style of bracing over the other.

On a number of other railroad systems, the experience with the larger classes of locomotives has been about the same as that given above.

A temporary repair for an incipient crack above the flues, is to plug the adjoining flue, the end of the flue plug to be nearly flush with the flue, the crack is then drilled out and plugged. Another method often used is to remove the flue, inserting in its stead a pocket in the front sheet and a sunflower in the back flue sheet, putting a plug in the crack and hammering over on either side. In good water districts these repairs are said to give good results and will last for a time under the worst conditions. A more preferable way of making repairs is to apply a patch of 5-16 inch or 3-8 inch plate, plugging the necessary flue holes, scarfing the flange down to a feather edge, or removing it entirely, and riveting the patch on the fire side, completely covering the sunflowers, making the patch from 42 inches to 54 inches long, a patch of reasonable length being more successful than a short one. Patches have been also sucessfully applied to the water side of sheet.

Regarding the methods employed for the prevention of flue sheets cracking, the following is pertinent: On a number of railroads the sling stay style of bracing, with an eye bolt in both crown and roof sheets, and the tee bar arrangement have given satisfactory results. The tee bar bracing is to be preferred as it is the more substantial. A serious drawback to the eye bolt arrangement is the fact that the eye bolts occasionally break, are sometimes not readily detected, and are inconvenient to remove, specially when the broken stay is located back of the front row; it is then necessary to remove the brace or braces ahead of it. Another advantage of the tee bar is that fewer braces are necessary, giving the front of fire box greater freedom of movement.

The bolts of these braces should be 1-32 inch greater in length, from head to shoulder, than the combined thickness of braces and web of tee bar, to allow braces to move freely. Care must be taken in applying braces, to insure sufficient space for expansion between either end of brace and leaf of tee bars. It is usual to slot the holes in the braces from 1-4 inch to 3-4 inch at the top end, or one half this amount at either end. In bad water districts, it is preferable to slot the upper holes only, on account of the liability of lower ones filling with scale, and causing the braces, in time, to become immovable.

In applying the eye bolt arrangement of sling stays, the following facts are worthy of note: The eye bolts for crown sheet where a button head bolt is preferred are made with an enlarged neck or shank, the button head bolts being tapped into the crown and hammered over. The eye bolts in roof sheet are either hammered over or nutted, a copper gasket being placed under the nut. When flat braces are used, it is customary to slot the hole in upper eye bolt. With the double jawed brace with forged eye slotting is unnecessary, as the oval shaped holes furnish ample room for expansion.

Regarding the number of sling stays, no standard is followed; from two to five rows are used. The same is true of tee bars, some roads using one, and others two.

For further prevention of cracks, we would recommend that no unnecessary work be done on flues, as it tends to destroy not only the flues, but also the flue sheet, also that upper flue holes be located not less than 4 inches from center of hole to inside of flange, leaving out 8 or 10 of the top flue holes, the front flue sheet pockets to be put in the second row from top where possible, beading the front end of the top row of flues to brace the front sheet.

A member of the Committee suggests that a 2 3-4 inch x 2 inch x 7-16 inch angle from 48 inches to 54 inches long be riveted above the flues to stiffen the margin, the 2 inch leaf to be uppermost and extending toward the front, the upper flue holes to be spaced 4 inches from inside or flange, with a reasonable radius at the root of flange. This would bring the top of angle opposite the point of tangention made by the face of sheet and the corner of flange, eliminating trouble on account of scale formation by the avoidance of a gap between flue sheet and angle.

In conclusion the following extracts from letters on the subject, written by members of the Association, will be of general interest.

In the first letter occurs the following: "We use the tee bar style of bracing on the front end of crown sheet, of our radial stayed boilers, of which we have a great many on our system, and I will say, we are having the trouble of cracked flanges at top of flue sheet."

The writer of the second letter says: "Our method of overcoming cracked flue sheets is to remove two rows of radial stays or crown bolts, and apply crown bars with sling stays, either that or tee bars. We have found this to have overcome the trouble we have had heretofore, with flue sheets cracking in the top row of holes, that is, through the knuckle of flange. We sometimes substitute eye bolts with sling stays attached, in place of crown or tee bars. This has done away with our trouble."

The third letter states: "We are applying the tee bar bracing, two bars on crown and two on roof sheet, spacing the top flue holes not less than 3¼ inches from flange, and increasing the margin above flues; but we find occasionally a crack above the flues."

In the fourth letter the writer says: "Our practice has been to allow a 2 inch radius at top of sheet, but this has not eliminated the cracking of the flue sheets; we are now trying a 3 inch radius. We apply also three rows of sling stays next to flue sheet."

The fifth letter says: "We have almost overcome our trouble by applying five rows of sling stays, and spacing flue holes 4¼ inches from center to outside of flange; since making these changes we have had very little trouble on account of cracks at top of flue holes."

H. J. RAPS,
A. N. LUCAS,
F. GRAY,
PETER ECK,
J. H. FILCER,
Committee.

The President: You have heard read the report. What is your wish and pleasure?

Mr. Wagstaff: I move the report be accepted and discussed.

The motion was seconded by several members and carried.

The President: Is Mr. Lester of the Erie present? Mr. Lester, kindly take the committeeship with Mr. Patrick. Mr. Doarnberger was on that Committee but I will be obliged to have him here as he is Chairman of a committee and his report is next in order.

Mr. Lester: Just before I go, I have a theory, not original, however, in reference to staying the crown sheet near the back flue sheet.

Of course, we all know, as Mr. Rapp says, that the expansion follows the line of least resistance, and I believe with all our practices, that this portion of the crown sheet is too rigid. I know that in our type of fireboxes flue sheets crack out at the top of flange; that when examining front end of crown sheet, in most cases the crown sheet is tipped up on account of expansion at that point slightly underneath the stays, and considerably so in front of them.

My idea is that when flues are renewed, after flue work is done, the sling or tee bar brace stays should be removed, and shortened up enough to put them on tension.

I would like to hear some discussion on this before I leave.

The President: Your idea is that if the whole surface on top was flexible or if there were sling stays from front to back all the way, it would allow the box to go up and down without causing any—

Mr. Lester: No, this is what I mean: that if you have a boiler with from two to five rows of expansion stays at the front end of firebox, you will note in most cases, upon examination, that after flues are removed, there is no tension on these braces.

The tension has all been removed by the expansion of the flue sheet and the crown sheet coming up with it as far as the braces will allow it and as there is no further room for expansion, the sheet cracks, for in the majority of cases it is found that after an engine has been in service about a year, instead of the braces being in tension, they are shoved up and are under pressure.

The theory is that when flues are renewed, if braces are shortened up and put under tension, when the boiler goes into service there will still be room for expansion and allow the crown sheet to go up with the flue sheet, and, in a measure, stop the cracking of flue sheets in the flange.

Mr. Brown: This subject of cracking flanges of our flue sheets is becoming a very serious problem. I note it more perceptibly lately with the road I represent. We are having considerable trouble. I feel that the Louisville & Nashville Railroad is on the right track with this flue sheet bracing and I would like to illustrate it to you. Instead of using a jaw brace we use a steel plate, making these holes oblong, as has been stated, using a tee iron suspended three inches above the crown sheet by a screw bolt through the crown sheet and also through the tee iron. We attach this by a 1¼ turned bolt, allowing, at least on top and botton ⅜ of an inch for expansion. By making this hole oblong we are not taking any of the strength away from the brace. We have the same area of metal on each side to support it. We make the hole long enough to give plenty of expansion. I would like some of the members to take the time to look over this. I feel we ought to go back two more rows of crown bolts. We have not sufficient play for this sheet to come up. And I believe a good addition would be to add one more tee iron. The tee iron we use is 39 pounds to the foot, made of soft steel. It is supported by a screw on the roof sheet. I stay all radial stay boilers in that way. I think if we could recommend an additional amount of flexible stay there it would be an improvement. The flexible bolt is a little difficult to apply in a radial stay boiler, as we lose the thread in the sheet on the side. This relieving of the expansion to radial stays at this particular point in my experience with high pressure boilers is very essential.

Mr. Borneman: I have flat flexible radial stays and boiler supports of a coupling design, which I think has overcome the cracking of the flange of the flue sheet above and also at the side. I have also overcome, I think, 50 per cent of the bottom flue leakage. I have had this in use for 18 months.

The President: To make it plain to the members, what you refer to is that you have a flexible stay as a brace on the bottom of the flue sheet.

Mr. Borneman: Yes.

The President: In addition to the crown?

Mr. Borneman: In addition to the crown. Although they are practically the same thing, they are used as a radial stay and also as a boiler brace. I have removed the tee bars and crown bars, and used the rivet holes on the wagon top and the crown bar holes and the crown sheets. Those stays so far have never given any trouble and the sheet has never cracked. The flange of the sheet and the flues have given practically no trouble. Very little caulking is required, because the flue and the sheet and the bolts all work together, thus preventing the flues from pulling in the holes, which, as we all know, happens when the sheet is rigid at the bottom. With rigid braces and rigid staybolts, the flues sag in the center and they are bound to pull on the sheet at the bottom, thereby making the bottom flues leaky. From the center of the sheet up the flues and the flue sheet all work together. They are flexible and bound to work together. That is the reason we do not have any trouble with them. By applying these braces after the tube is applied, the bottom is the only one that has to be removed in renewing the crown sheet or the fire box. They can be disconnected at any time. You can use the same thread on the wagon top by renewing or straightening the old thread and using a short cap with a guide.

The President: Mr. Elkins, will you kindly state what the stretch of a flue is. I believe you trammed one of them years ago. I mean from the time it went in until it was removed, in the center of the sheet.

Mr. Elkins: Not having the records here, I cannot tell.

The President: It seems to me it was something like an inch and a quarter. What I wanted to bring out was that the working of the flues would stretch your flue sheet, and then they have no strain on them, that is, the first row of braces.

That will occur after four or five weeks or a month. The oftener you work the flue the quicker the sheet will stretch. The sheet going up takes the strain off of the braces, and when the prosser comes down it will push down the crown sheet.

Mr. German: We are experiencing much trouble on the Lake Shore in the cracking of flue sheets in the top flue holes through the flange and the rivets, and also in the knuckles of the flange. We are welding these up. We have about seven engines with these cracks welded and they are running very successfully. Without doubt it is the working of the flues frequently that causes stress on the sheet and that it releases itself as an upward movement. On the Indiana, Indianapolis & Iowa we have 10 engines with high pressure boilers having two solid front bars. These bars are fastened with a bolt just the the same as a brown bar boiler, and in between each of the crown bar bolts a hole is drilled in the bar ¼ inch with a radial bolt running through the top with a nut underneath it. These bars are nine years old and we have not had a flue sheet flange go up or crack on the boilers. As I have heard it stated, different members are applying tee bars. I feel very much inclined to fall in line with them on account of these 10 engines we have had in service nine years and that have had no crack.

Mr. Wagstaff: During the last 18 months I made it one of my specialties to look into this subject. If the Association will bear with Mr. German, I would very much like to see the application he has spoken of shown on the blackboard because it appeals to me as one of the best ways out of this problem, the cracking of flue sheets. Putting the bolt down from the top to the bar allows the tube sheet to go up but prevents it coming down.

Mr. Wanberg: I am greatly in favor of the tee bar or crown bar in the front part of the crown sheet. Very recently we have had in service in our district in Minnesota and Dakota two boilers practically of the same power, although not exactly the same type, one having the eye bolt and strap brace, the strap brace being slotted so as to give it a chance to raise and lower with the contraction. These boilers are not giving us the satisfaction afforded by those that have the double tee irons. We have no trouble with the cracking of the top of the flue sheets on the engines that have the tee bar. Some of our new engines, however, that are not a year old, I discovered just before I came here, are beginning to crack out from the top flue hole, going around toward the rivet, which means that in at least a year I will have to do something with them. I am strongly in favor of increasing it to three tee bars and I believe it would greatly overcome our troubles. At the same time I don't know anything that would overcome it all. The expansion of the flues is so much greater than that of the boiler, that we will have more or less cracking, but it will be overcome to some extent. I find the same boilers in good water have not shown any sign of cracking in the least, but in our bad water district in less than nine months new boilers began to crack. Of course some of this may be due to the fact that with our bad water, flues have to be worked every trip and in the good water district they may be worked once a month or once in six weeks or maybe longer. This cracking is often caused by allowing our boiler makers to drive their expanders in as far as they can when the engine is hot. I think if we would watch our boiler makers a little closer we would overcome a great percentage of this trouble in the top of the flue sheet. When we come to sum it all up, I believe it is not altogether due to the bracing, although that has a good deal to do with it.

Mr. Kelly: You seem to dwell on the staying of the crown sheet and the flue sheet, but I hardly think that is all there is. We have more to consider. The flue setter starts in the fire box to set the flues, and the crown sheet is perfectly straight. He goes in there with a hammer, sometimes a pneumatic hammer. I believe a pneumatic hammer is not as heavy as a heavy sledge hammer, especially if he is a strong man. Some flue sheets have 5-8 bridges and some 11-16. The finer and smaller the bridge, the worse it is for the sheet. He starts at the bottom and works up. Where is that sheet going to? You are crowding it up by degrees, and where is that stress going? It is spreading out. It can't go out on the side so it all goes up. Then just as quick as that sheet becomes warm it works upward. When you have plenty of lee-way in the sling stays to allow the crown sheet to go, all right, but if you don't, the crown sheet becomes solid and goes up at the back flue sheet twice as fast. It is up to us to set those flues and make our flue setters distribute that load. We fasten the sheet with two rows down the center and two rows across, we expand in quarters, both ways, starting in the center. I believe it is as much in the workmanship as in anything else that makes these sheets break. I want to ask if any of the men here ever measurd a sheet after it has been hot once, after the engine has been in service, fired up and had full pressure?

The President: You mean to measure it before being fired up? And after?

Mr. Kelly: Yes. I believe the cracking of our flue sheets on top is largely due to working of the flues in the roundhouse, and I would like to ask Mr. German about that engine that has been running 12 years, how often the flues have been worked.

Mr. German: That is one of the worst water districts there is in the country, where we get 58 grains of salt to the gallon.

Mr. Kelly: How often were the flues expanded?

Mr. German: I can hardly tell you that.

The President: State whether the flues have to be worked at each end, at the terminals.

Mr. German: No, sir.

The President: How many trips would the engine make before working the flues?

Mr. German: Probably two or three trips.

Mr. Kelly: How often have the flues been changed, every nine or 10 months or a year?

Mr. German: The foreman boiler maker is here. He can tell you. We have run those flue sheets for 50,000 miles.

Mr. Kelly: You are not in bad water then. We had an Atlantic type engine, No. 1015. I guess it was one of the first that there was built, that ran on the New York Central before it was turned over to the Chicago & Northwestern Railroad. That engine did not have tee bars, it had eye bolts, same as the old class had. We just removed that sheet and it was cracked of course. It had eye bolts and sling stays. It seems to me that engine with eye bolts and sling stays did just as good as a good many we have with tee bars on.

The President: Were the eye bolts continuous from front to back, all the way back?

Mr. Kelly: No, five rows, twelve each side of the center. I found the flue sheet with eye bolts that had good lee-way top and bottom, have been doing as good or a little better than tee bars. Another important point on cracking to top of back flues sheets, which the staying of the crown sheet has nothing whatever to do with, is the location of top flue holes. This is certainly up to the General Foreman and Foreman of Boiler Makers. Do not put a flue hole in the heel of the flange, especially on the top of a back flue sheet of a radial stay boiler, and then wonder why they crack. Keep them down 4 inches to 4½ inches from the top, cut out flues, where the holes are to close the flange, then watch and see the result, and I know you will prevent this cracking. I thank you.

Mr. German: We have some engines on the same road with rigid bolts that never had a crack on them.

Mr. Kelly: I believe, gentlemen, the whole trouble is right in our roundhouses, in expanding the flues. We have to take into consideration the bridge and the dropping down of the flues, and if you drop them down too far they will crack crosswise. If you drop them too far they will crack all the way across the top, so you have gone from the frying pan into the fire. I believe 4½ inches from the top of the flange to the center row of the flue sheet will give best results. I believe the flue sheets should be stayed, the front flue sheet to the back flue sheet. We have a large space there, we are depending upon the bead of the flue to brace the sheet. The engineer who works with a strong injector has a good deal to do with the flues leaking on the bottom. We have engines of 350 flues with the bottom flues leaking every trip.

Mr. Doarnberger: I rise to a point of order. That has nothing to do with the breaking of flue sheets.

The President: Proceed, Mr. Kelly.

Mr. Kelly: We have cut out 45 flues on the bottom of the engines and have substituted stay rods, and we are having fine results. I believe the back flue sheet must be taken care of by stays of some kind to prevent their buckling and later cracking. This subject needs our careful consideration and should not be dropped too quickly.

Mr. Lucas: I have no stayed flue sheets, that is, the back flue sheets, but I believe our trouble begins from the time we start to put in the copper shim. It has been stated on this floor a couple of times that a man putting in the copper shim has stretched the flue sheet a sixteenth of an inch. When we tram our flue sheets after we work our flues, the sheet has stretched one eighth, and in working them in the roundhouse we find they have stretched them again one eighth. Where you work your flues often, the stretch continues to grow, until it is almost impossible to expand and calk your top flue, due to the flange coming down. This will happen irrespective of how the front portion of the crown sheet is stayed. I don't believe there is any way to stop it only to let the boiler maker know that this trouble is due to the working of the flues. I don't think staying the flue sheets in that way, from sheet to sheet, will help to stop it, and I don't think 3 tee bars will stop it, for the simple reason that our flange comes down from the first bar four inches from the flue sheet, and if we put another bar on there the crown sheet would go up just the same.

Mr. Doarnberger: I believe that the idea is to devise some means to take care of the so-called movement, or in other words the expansion which is supposed to take place between the crown sheet and that of the roof sheet immediately over the flue sheet. Like all others whom I have had the pleasure of hearing discuss thi ssubject we have our troubles with the flange knuckles cracking through from the flue into the river holes, or vise-versa as the case may be, and have made a close observation of the same. At times we would find the cross pins that tie the sling stays to the tee bars jammed. We confidently thought at first this to be the prime cause for the cracking of these flue sheets. In order to make sure and be certain as to this theory we have upon finding similar cracks gone into other boilers, and to our utmost astonishment we found the pins free, they having ample room to move. My opinion is that we get a number of our flue holes entirely too close to the flange, and I may add further that the flue and crown sheet sets up a movement from the center each way, they being constructed of a large radius approximately at from 70 inches to 80 inches. Then uniting as they do on either side with a smaller radius at from 12 inches to 18 inches, the latter being very rigid and unyielding, naturally this would throw the stress to the larger radius at which point or just at the break line where these two radius unite is where these cracks take place.

In order to try and overcome these troubles the Norfolk & Western some eight months ago equipped one of their large 100 ton class "M" freight engines carrying a working pressure of 200 lbs., with a complete installation of flexible stays, that is to say, all in the throat sheet and six rows on either side sheet up to and including the six rows of radial or crown bolts next to the flue sheet. The flue sheet braces were also made of a flexible type. It will be readily seen that this flue sheet with the exception of where it is riveted to the fire box sides, crown, and mud ring, is free to move at all directions.

Mr. Lucas has just stated that he has frequently seen flue sheets stretch at from 1-16 inch up to and as much as 1-4 inch. This may be true, but I have never seen it. The flue sheet I am speaking of is but 3-8 inch thick. After all work was completed and before any of the flues were applied we tramed the sheet with a series of solid trams and centers, then again after all the flues were rolled, upon the later or second traming, we found that the sheet had not moved or stretched a thousand the part of an inch. The engine has now been in service some eight months, the flues have been worked on probably as much as 400 times. and on an average of about 25 flues to each working. The flue sheet is tramed every 90 days and to nate this sheet has not moved or stretched a particle; yet we are not quite ready to believe that a flue sheet will not stretch by the constant rolling of the flues. What we do claim is that the copper ferrules being soft and yielding will naturally take care of this stretching, at least for a reasonable length of time.

Mr. Rearick: In the last ten years on the road I am connected with, we have used a sling stay and that stay has lots of room for expansion. Last week I inspected a passenger engine boiler that carries 200 pound pressure. I found that the flue holes nearest the crown sheet had several cracks extending from edge of hole upward to knuckle of flange.

Now it appears to me that the expansion up and down is not alone responsible for this defect. The four (4) front rows of stays are sling stays with an oblong hole which admits of expansion and yet we have the small cracks. The top flues I referred to have been removed twice in five years. My opinion is that there is some other cause that the trouble can be attributed to.

As I stated before, all of our engines are built to admit of expansion of flue sheet but it appears from the remarks of some of our members that no allowance was made for this on certain styles of boilers. I have a blue print here, which shows where the expansion is.

Mr. Brown: Suppose you put it on the blackboard.

The President: Mr. Laughridge, will you draw a flue sheet?

Mr. Brown: With reference to this radial stay bracing, we are going to assume that the working of flues will be effective on the flue sheet. I claim that it will bulge out, but I fail to comprehend where the rolling of flues is so decidedly effective out near the flanges. These cracks I have referred to do not run vertically. They run with the flange and crack immediately in the flange. These little fire cracks that are vertical will happen any place. What we want to eliminate is the cracking of this flange. I will call it horizontal or across the top of the box. I hope the members who have been giving their experience before this assembly have had some experience with the radial stay, the radial stay boiler. The Belpere does not give us considerable trouble. Mr. Doarnberger has come close to my sentiments. We must provide for expansion. It is there and it has no place for distribution. The flue sheet has an upward tendency of expansion as the boiler becomes hot, and it travels no other way than upward. I have known crown sheets to be damaged to the extent of being driven up as much as three-quarters of an inch by this expansion. The flange in its movement from the heat and cold produces a "breathing," from the fact that it is rigid on the top and has no place to go. It must do something, consequently it will leave a stress there and it will go sooner or later. We have high pressure boilers on the L. & N. that have given us this trouble in three years. That will not do. This "breathing" backward and forward, as you all know, will eventoally give way on the weaker side, which is the inner side of the box, and at the immediate root of the bange. Some place of this expansion must be provided for over the top of the flue, and when Mr. Doarnberger said six rows it met my approbation. We found this tee iron bracing to be the beginning of a better end, but I will not say to take two rows; I will go on record advocating four or six, and I am thoroughly of the opinion that the result will be good.

Mr. Hempel: So far as the staying of the crown sheet is concerned, it has absolutely nothing to do with the cracking of the flue sheet. The staying of the crown sheet is simply to keep the crown plate from coming down. The provision that is made for expansion through the slot, as represented on the blackboard, or any expansion stay, is simply to provide for the upward expansion of the box. This has nothing to do with the cracking of the flue plates from the rivet hole out to the flange. It should be in the manner I have marked on the board, from the flue hole around the heel of the flange out through the rivet to the caulking edge. The real cause of the cracking of these plates is due to other causes than the staying of the crown plate, possibly to the overworking of the flue. A stress is put upon the plate, and each time you work the flues you put on more, and it must go somewhere. Eventually the crown plate, put in at 70 inches, when removed would be 70 1-4 inches and would be in this manner. The crown plate has never come down. Put a straight edge on the crown plate from the rear to this part and it is straight. Your flue sheet has grown from 70 to 71, maybe more. Staying with the sling crown bar, with the eye bolt, with the flexible bolt, with the straight bar and all, so far as the growth of that plate is concerned ,the effect is the same. So far as the construction is concerned, it is different in every class of engine. In every class you will find different things. In a large railway system that has a great number of engines, you will find various conditions and various causes. Where you must work your flues more you naturally have more trouble. But I hold that the staying of this crown bar box as keeping withing the limits of this paper, has nothing to do with this cracking. If we want to get away from that cracking, we must make other provisions, and the only way to do that is to send that stress some place else, take it away from this point. With a Belpere boiler, you all know what takes place there. That expansion runs out in this manner. With the radial stay it cannot go any other place except at the top, because there is where it is loose. We have taken this out and brought it down here about four inches or more, then stiffened this, and then cracking takes place there and it will eventually work out until you have a pretty fair sheet, leaving as many flues out as possible, perhaps 20 in the engine. Then that sheet will begin to tumor in and out. Mr. Kelly says: "I believe in staying the plate." Why? Because he has overcome the difficulty in one place and has put it in another, and now he is after that place. He has overcome this difficulty, but he has caused his plate to move. In ordering a set of flues for a new engine, you order them a certain length. In the course of time you order them longer and put them in longer. What makes the flues longer? Many of you have flue sheets two inches longer than the flues were when the engine was first bought or when the flues were applied. Those plates have worked to some extent. As I understand you, Mr. Kelly, you put a rod through.

Mr. Kelly: Yes.

Mr. Hemple: I am as far at sea as anybody else, but I say, no matter what you do, you eliminate one difficulty and get into another. So I am thoroughly convinced that the staying of the crown plates has nothing to do with the cracking of the flue plates. (Applause.)

Mr. Johnston: I endorse Mr. Hempel's remark to the very letter. As to Mr. Brown's remarks relative to breathing of this flue sheet, I would like to ask why the door sheet does not also breath! Is there not the same expansion on this door sheet that there is on the flue sheet? And you all will agree that there is no distortion upward on the door sheet flange, consequently Mr. Hempel's explanation is the only one.

The President: I have removed door sheets that were broken from the top staybolt hole around in the flange and I guess others have had the same experience.

Mr. Johnston: In one, or possibly two per cent of your engines, but I venture to say that you did not find the distortion upward as you do in your flue sheets. In my opinion, these defects were caused by abuse of material when flanging same, prior to first applying. And, Mr. President, in regard to the flue sheet and cracking of flange, in my opinion there is only one solution and that is a sharp corrugation at the top of the sheet, just over the flue, this corrugation to extend down on a line with the bottom row of flues, which would allow the distortion caused by excessive working of flues to cencentrate at that point.

Mr. Lucas: I stated a few minutes ago that I did not approve of bracing either the flue sheet forward and back to prevent the flue sheet going up, or to prevent the cracking of the flue sheet across the top of the box. I would stay the flue sheet across the top of the box. I would stay the flue sheet where you increase the space from the flange down to the top flue hole to 4½. I believe the braces would be all right there, but that would not stop the flue sheet going up. We must learn to expand our flues in the sheet without working the sheet, and when we re-work them, we want to do the same, and we will get all we expect out of the flue sheet. Pracing over the top I believe is immaterial.

Mr. Brown: In respect to the question of a member who asks only why the back sheet does not crack, my friend, will you not assume that the temperature at the flue sheet is greater than at the back sheet?

Mr. Johnston: Two-thirds of the heat in our fire box is taken from the door sheet, and we don't have that condition there.

Mr. Brown: Naturally the exit for the fumes is forward, and I presume that there is greater intensity of heat at that part than there would be at the rear of the box at the same place. In regard to this cracking, I think it is the vertical crack to which Mr. Lucas refers.

The President: Mr. Brown, the members perhaps do not understand about these cracks. They take place in two ways, vertically and horizontally. The vertical cracks generally take place when the holes are up close and the horizontal cracks when you drop your flue sheet.

Mr. Brown: I attribute the cracking of the upper row of flues to abusive operation. They play on those flues when they ought to leave them alone. The round house man goes up there rather too often. I believe if he would stay in the territory where his services are required this would be eliminated, Neither am I of the opinion that we need anything larger than a three-quarter bridge. I don't think we need any more surface than 2½ inches from the top of the flange to the center of the flue holes, provided that will act as an avenue for this expansion, which is so damaging to that part of these high pressure boilers—I mean the radial stay boilers.

Mr. McKeown, Sr.: I have two or three cuts here designed for different classes of fire boxes. We have all been through the mill with this cracking, and still they crack. We have radial stays and sling stays, and still they crack. I admit that this is a very good stay, this tee bar; it is all right. We have those flue holes cracked. We are in a hard water district. The flue sheets go up just the same as it is marked on the board. It was Mr. Brown, I believe, who spoke about the expansion going up ⅜ or ¾ of an inch. I would like to ask if that comes down again; what do you do with it when it goes up?

Mr. Brown: In answer to the question, Mr. President, this expansion sets in at the flue sheet and raises it, and presently the outer shell becomes hot and travels away, retaining the strain.

Mr. McKeown: I don't make the knuckle of the sheet five or six inch radius like this sketch; if you do, you have the trouble horizontally across the sheet. We must keep the knuckle of the sheet this way more and drop the flue down, and then that is perfectly straight. Here is a sheet here. We don't have any trouble with this sheet cracking through the hole. The expansion is the other way on this sheet. With regard to the flues leaking and the flues working up we have more trouble with the bottom flues ten to one than we have at the top. We very seldom interfere with our flues above. Our trouble is all below. The sheet goes in and out like this. (Indicating.)

Mr. Brown: The more you work the bottom flues the more the sheet bulges out?

Mr. McKeown: Yes, the pressure naturally comes with the heat. Take a sheet of iron of any kind and lay it on the floor and put a heater on it, what way will it go? To the fire, every time. We are leaving those flues out, keeping them further away, but we are not making the big radius. If it is done, unless you put in some stays it will break the other way. As I said before, we don't work the top flues as much as those at the bottom. There is no occasion for it. Here is where the main trouble is. We are putting in flues with a wider bridge. If you have a sheet which you have to straighten, the oftener you do so, where is that stock going to?

Mr. Brown: You upset it?

Mr. McKeown: Yes, we upset it and it goes together. If we make an oblong hole we ream it out.

Mr. Johnston: Don't you caulk the top flues?

Mr. McKeown: Certainly, but not very often.

Mr. Johnston: Our flues leak all over. On account of the large amount of brick we have in our oil burners, in cooling them down, it is absolutely necessary that we caulk every flue, 391 flues, 20 feet long, every time. We get those cracked sheets, and we get the heat so bad on the back end of the fire box that it will burn the flangeof the door sheet into a crisp.

The President: Please let Mr. McKeown finish.

Mr. McKeown: Sometimes on the door sheet we have a little trouble, but that we attribute to the material. We have quite a number of engines of this class that give us trouble with the material. What we want to take care of is the cracking out of these flue holes. If you have any better result or better way of stopping the cracking out, I would be glad to know it. The sling stay don't seem to give any better result.

Mr. Rearick: There is a point in this sketch—

Mr. McCartney: I rise to a point of order. Nobody on the floor is allowed to speak twice until every member has spoken. I believe to overcome the cracking of the flue sheet, better men should be put in the round house. Under the rules of every shop in the country, if a man is no good in the shop, put him down in the round house. They use no judgment. They crack them with the expander. It is the poor men in the round house who give us a great deal of trouble.

Mr. Rearick: The crown sheet, I claim, expands proportionately with the heat, as the flue sheet. This sheet is expanding up and down. Here is your crown sheet expanding fore and aft. Now, then, if it was the constant expansion and contraction of the flue sheet that made these cracks, it would crack on the knuckle. In addition to that, you have the intense heat in the flue that is coming through. In addition to the crown sheet heating and the difference between the two expansions, it puts the strain there and starts the crack as is represented. These small cracks eventually extend to the knuckle—it goes to the center of the flange. I claim the evidence does not show it is the expansion alone from the flue sheet, but is superinduced by the crown sheet and flues. If it was the flue sheet alone the crack would be longitudinal, but it is not. With the conditions on our road, the cracks are in this style, eventually going through the flange.

Mr. Gray: We are dealing with the business end of the boiler. It is the part that gets more abuse han any other. In my estimation, the only way that we will ever prevent those sheets cracking at the top is to change the design of the sheet. I think the boiler makers and mechanical engineers have been holding on to that design long enough. They cannot, with the present design of flue sheet, prevent cracking at the top in the course of time. Undoubtedly excessive working of flues has more to do with it than anything else, and the setting of the flue starts the sheet stretching in the first place, and each time the flues are used it adds that much to it. I have found in my experience that the less flues are worked in the round house or the better they are worked, the longer they will last. Few sheets crack short of three years. We have been working on flues entirely when the engines are hot. This makes less work necessary to do a good job and prolongs the life of the flue.

The President: Do you work your flues hot?

Mr. Gray: Yes, while the engine is warm.

The President: It stands to reason that that will stretch the sheet quicker.

Mr. Rapp: I would like to ask Mr. Gray if he works his flues before the boiler is washed and whether it is washed with hot or cold water?

Mr. Gray: Before the boiler is washed. It is washed with cold water.

Mr. Elkins: I would like to say a word in regard to the bracing of crown sheets to prevent flue sheets cracking. I believe that most of the trouble is with the flue sheet. On the road that I am with we are putting 1" bridge in all our back flue sheets, where we formerly used 11-16". The flue sheet would go up 1 1-11" in three or four years necessitating the removal of same. Where we use the 1" bridge the trouble seems to be eliminated, as we have engines running three or four years that are in good condition. We use two rows of eye bolts next to the flue sheet with jaw braces or a tee bar; personally I prefer the tee bar account of being able to use bottom head bolts in the crown sheet. The bar should be 1¼"x6"x6" supported from the roof of the boiler with 3¼x3" soft steel strap braces, 1¼" pins in each end; holes in top to be elongated ⅜". In this connection we do not use flue roller in back sheet at all, setting all flues with the prosser expander and for round house work we use a mandrel pin or prosser, caulking with air hammer.

Mr. German: Mr. Chairman, I wish to call attention to 10 engines that we have on the Chicago, Indiana & Southern. They are high pressure boilers and have two solid front bars on them. The bars are fastened with a bolt, just the same as a crown bar boiler, and between each of the crown bar bolts a hole is drilled in the bar 1¼" with a radial bolt running through the bar with a nut underneath it. These boilers are eight years old and we have not had a flue sheet flange either go up or crack on this class of boilers.

I have heard it stated that different members are applying tee bars. I feel very much inclined to fall in line with them on account of these 10 engines we have had in service eight years and none of which has cracked.

Expanding the flues has a tendency to force the sheet up, but with regard to this class of boilers with the crown bars on, I want to show you the design as near as I can. (Going to the black board, making a sketch.) That has a 4" radius. It has a thimble underneath the bar 3" long; this is a radial bolt running through here with a nut on it; that is 1¼" hole to allow freedom of bar to work. It is 14" from there to there to the next bolt. With that class of boilers we never had any trouble. I think it is in the design more than the working of the flues, while I believe the working of the flues has a tendency to crack the upper flue hole.

A Member: How much pressure do you carry?

Mr. German: 190 pounds pressure.

Mr. Goodwin: Possibly it would be well for us to look into the subject of a changed flue sheet while we have this up. Last night I had the pleasure of looking over a corrugated sheet that had been designed by Mr. Wood. In other words, he is the author of it. I suggest that if this committee would take hold of these prints of Mr. Wood's and look into them, possibly they might find something that would be of interest to the Association.

Mr. Laughridge: I will have to concur with Mr. Lucas and Mr. Hemphill, that the working of the flue has more to do with it than anything else. We had 25 engines equipped in the manner mentioned by Mr. German, but instead of the solid bar, it was a skeleton bar with a bolt through and a washer, and the plate came down from the roof sheet to the nut underneath. They ran a year and a half and the flue sheets were all cracked. In our locality we have so much trouble in getting them clean that we took the bars out, threw them away and put the straight stay in, dropping the top row of flues out, making it five and a half in the center to the first row of flues, and it decreased as it came to the outside. Those fire boxes have been running now for eight years and they have never had a crack in them. We changed the engines to another division, where the flues are not worked very often, and we have never had a crack, and I am satisfied that the working of the flue is the greatest cause of the cracked flue sheet. However, I think there ought to be a good deal of stress placed on the theory about the crown sheet. If you take a straight sheet like a Belpere or an old style crown bar boiler, you never see a flue sheet cracked out, but if you take a piece of metal and flange it square, like an angle iron, and put a pressure on it, the pressure will be distributed, it will be a bow, and it will be distributed from end to end. In other words, it will be distributed from the corner of the flue sheet to the corner. But if you put a rise in it of five or six inches, then the pressure of your crown sheet comes up—that is the expansion. The force is reduced to the center of your sheet, and it will break more readily than the straight sheet, because you have reduced it in the center. I firmly believe that the excessive working of the top flue or of any of the flues is the principal cause of their breaking. Of late years we never allow the round house men to work a flue hot, to use expanders in the flue while the engine is hot. If the flues require expanding, wait until the engine is cold. If there are four or five rows in the top that do not need working, they begin on the top row that does need it and work three or four rows down, and then work around and around, and finally wind up in the center, to allow the sheet to drop in. In that way we are getting good results,and we have not had a broke flue sheet in eight years.

Mr. Sarver: Most of the boilers on the road with which I am connected are Belpere's, and very seldom has a flue sheet cracked at the top; but we have those oblong holes. The flue holes are the top holes of the outside rows.

The President: Are they radial or Belpere?

Mr. Sarver: They are Belpere. We do have this trouble. There are two rows of flexible bolts next to the flue sheet. The flue-crown sheet goes up and relieves those bolts, and the outside sheet cracks between the flexible sockets on the inside of the sheet. We have a number of sheets that crack at that point. We do not have any flue holes cracked on the top of the flue sheet on Belpere boilers.

The President: We have present Chief Mechanical Inspector Nash of the Louisville & Nashville. If he will step forward and say a few words to us it will be appreciated. (Applause.)

Mr. Nash: Mr. Chairman and Gentlemen—I feel highly elated over the privilege of addressing this intelligent body, but knowing your honorable President as well as I do, in fact, being very closely associated with him at one time, I am afraid he is using this method of getting back at me. (Laughter.) He knows that I am not qualified to say anything at this time, but I am glad that I am here. Of course, I am a little bit late, but I was well represented just the same. I am sure we will all be greatly benefited by this organization and that great good will be derived from what is handled here. If I attempted to say anything more, I am sure it would only result in disaster to me, and some fellow might say, "Get the hook." I thank you. (Applause.)

Mr. Lowe: I have been very deeply interested in the discussion of this paper this morning. On the Canadian Pacific Railway we have attempted almost all of the different methods which have been described on the blackboard. We have come to the conclusion that the cure for this trouble must be gained in another way, and at the present time we are experimenting along other lines. We believe that most of our trouble in the fire box is attributable to the circulation of the water; that the circulation next to the back tube sheet is all one way, and not so at the door sheet where the circulation is not so violent. Now I cannot go into details of the experiment that we are introducing at the present time, because it has not been in operation long enough, but I believe that we can cure a great deal of this trouble by providing a circulation which will be both downward and upward, the steam rising upward, and the more heated water coming to the top, will be provided with means of getting a fresh source to the bottom to supply the different points where the most excessive heat forms. We believe that the most excessive heat is at that back tube sheet, more particularly at the top, and among the bottom tubes and wherever the greatest excess of heat is; that is the point where we want to get the water, and where we have not got it. I believe that explains why the door sheet end does not crack as frequently as the back tube sheet. I do not think that the sectional expander, or the staying of the flue sheet, plays an important part with the failure around the circumference of the tube sheet, because we have engines that we can operate for a general repair; that is, until their tires require turning, and do not require a caulking tool on them. In other places we have to caulk them at both ends of the road, and in some places we have to work them out at both ends of the road. Of course where we have those conditions, the cracking of back tube sheets is more aggravated than in good water districts. Greater heat forms next to our fire plates in such districts than where the water is good. I hope that when the next convention is held I may be able to give you the results of our experiment in that connection. I thank you. (Applause.)

Mr. Goodwin: In view of the fact that we have four more subjects to handle between now and 1 o'clock, I move that this discussion close at 11:45.

Mr. Lucas: We are here to adopt something in regard to this question. I believe that the method presented on the board, the crown bar across the flue sheet, in order to brace the front portion of the flue sheet, is as good as any. It has been said that flues are only caulked in the center. At the same time, when the flues are renewed, they have to put in larger copper shims all over; it seems to be stretched all over and the flange seems to be coming down. Take the engine that is giving the most trouble. Take her out of service and put her in stationary use, and the trouble ceases immediately, going to show that conditions are the cause of all these troubles. Where we are continually working the flues, the flue sheet is going to pieces rapidly. Where we don't have to caulk the flues, our flue sheet stands. I cannot say that we are having much trouble on our system. We are getting better than 200,000 miles between flue sets. In the last three years we have put in about three fire boxes. I have not come here with a tale of woe. We are doing nicely, but I believe that any method of bracing the front part of the crown sheet will answer as well as the one shown.

Mr. Linderman: About four years ago, I had an experience similar to that of Mr. Doarnberger. We had a class of engines that cracked from the top flue holes to heel of flange in seven months. We patched the sheets, keeping the engines out until they made their mileage, when the sheets were renewed. We then put in flexible staybolts on the sides at front of the box, extending from the mud ring up to and including the sling stays, which in some engines extended back six rows. These sheets are still in these engines, some of them being in service over three years without the flue sheet cracking.

Before installing the flexible staybolts, the flue sheets were bound on the side up to the sling stays with rigid bolts, the result being that any expansion due from working the flues or from other causes went to the point of least resistance, which was at the top of flue sheet owing to the sling stays at this point. This action, I believe, is the principal cause of the flue sheets cracking from the top flue holes into the flange. By applying flexible staybolts the expansion in the sheet is allowed to radiate from the center and is not concentrated at one point, owing to the back play allowed by the flexible staybolts. We have an Atlantic type engine, that has an entire installation of flexible staybolts. This fire box has 1503 staybolts and there is not a rigid staybolt in the boilers. This engine has been in service a little over two years, and the last time I made an examination there was not any perceptible sign of the flange coming down.

Mr. Goodwin: Is there a second to my motion, that the subject be closed?

The motion was seconded by several members.

The President: Give Mr. Kelly one chance and we will close the discussion.

Mr. Berry: Mr. President, it seems to me that two or three gentlemen ought not to be allowed to have the floor all the time. Many gentlemen here would like to say something. The gentleman who speaks should concentrate and allow the others to have a chance.

The President: If any of the gentlemen wanted the floor, I did not see them rise and ask for it.

Mr. Kelly: Mr. Goodwin called our attention to the corrugated sheet. About two years ago I did some experimenting along this line. In putting in the corrugation across the top of each flue sheet I could not put in all the top flues, so I left out 11 or 12, and substituted stay rods. I just wanted to call the members' attention to it. I don't want the floor all the time. That stopped the sheet from cracking across the top, the flues did not leak as much, and I would like to have Mr. Hedberg, who has this engine on a bad water division, tell the audience where that sheet is cracked. I have not seen it since.

Mr. Hedberg: When they sent the engine to us, it came out on the west division and ran from eight to 10 months. The men were expanding the flues, and I hardly ever expand more than half of a set like that. During the operation of working the engine, she cracked out there.

Mr. Kelly: What was the condition of the crown sheet?

Mr. Hedberg: The crown sheet was all right, but this sheet was working just the same, going up. The crown sheet was not working so bad because the O. G. flange took it up. It was working up and closing the space between the sheet there and this point. I think in time it will crack here, because it has this movement, and you cannot get away from it. When I raised the question with Mr. Kelly I thought he ought to carry it here and put a free stay here. Instead of that you run right to the edge of the solid radial stay as shown here.

Mr. Kelly: How large a patch did you put on it?

Mr. Hedberg: Just a small one, six by five. So far it is as good as it was when made. It will be three years next month since it was put in service. But they crack just the same. When you take it away from one place, you will get it somewhere else. You were speaking about the other part where you took out a bunch of flues in the middle. We stay the sheet by putting in a few flues, and that helps to stiffen the sheet. Mr. Kelly developed that idea. He left some flues out at the bottom. When the engine had been in service six months, the flue had expanded, but with very little leakage. They steam just as freely and we don't have any trouble.

Mr. Finacane: I would like the gentlemen to tell us how close the flue hole comes to the heel and to the root of the flange.

The President: They are all the way from two to four inches.

Mr. Hedberg: He cut out the top row. I did not measure it at the time, but I should not think over four inches; but we put a stay rod through where he cut the flue out, and it acted the same as a flue would, it fitted in the same hole.

Mr. Brown: Put a stay rod in in place of the flue?

Mr. Hedberg: Yes.

The President: Any further discussion on the subject? There is a motion before the house to close it. Would it not be a good idea to continue this after luncheon?

Mr. Kelly: Let us continue this subject. Men are here who have not been able to get the floor. Let us get the ideas of all who are here. This is too important to drop.

Mr. Newman: We have had a good deal of experience with that class of boilers on the Southern Pacific. The tubes come up as close to the knuckle as we could possibly go with them without going into the bend, and we are having pretty good success. We had a great deal of trouble with this cracking out up here. Those are radial stays. We figured out that there was more metal up around here than there was right across here, and that was the cause of this cracking, and we laid out a fire box plate on the front end the same way as it is on the back end. That was the shape of the box.

The President: Is that the back flue sheet?

Mr. Newman: That is the back flue sheet. We cut out 10 flues. We reinforced the front flue sheet and put on braces in order to compensate for the flues we had taken out. We have that engine running between Houston and New Orleans, 360 miles, with an oil burner, and it has been there two years. There is not a sign of rupture either way, up or down, or crosswise. The way we put the radial staybolts in was this: we had the hole reamed to taper from the bottom. The rest of the box had regular radial stays. The first flue hole is two and a half inches from the top of the hole to the top of the sheet.

A Member: How far back did you flatten the crown sheet?

Mr. Newman: Something in that shape, running to a flat surface across here from the door sheet to the front sheet.

A Member: How far back from the front of the flue sheet did you begin to form the flat surface?

Mr. Newman: Started right at the door sheet and the door sheet came down like that. There is a 2½ inch drop to the street.

A Member: Is that high part at the back or the front?

Mr. Newman: The high part of the sheet is on the front, on the regular fire box, but when we cut it down it is practically level at the center of the box.

Mr. Brown: This crack that you refer to runs lengthwise of the flange?

Mr. Newman: The cracks running up and down were the ones we were getting after. We claim there is more metal around the top than there is across here with the solid plate.

Mr. Brown: I mean the crack in the root of the flange did not present itself?

Mr. Newman: No, sir, there is no crack either way.

Mr. O'Connor: The subject under discussion is an important one to all the members of this Association, especially to those who have under their care the modern high pressure locomotive boiler. Presuming that all railroads here represented have this type of boiler in service, it might be safe to say that all, or nearly all, have the same trouble, namely, cracking of flue sheet bridge at top flue holes, cracking from top flue hole around root of flange to rivet holes, cracking of flanges parallel with top flange, also oblong flue holes at top rows. One member that preceded me on this subject relative to the cracking of this particular part of the fire box said that expansion and contraction had nothing to do with bringing about these bad results.

You gentlemen, particularly those of you who have had charge of railroad boiler shops during the past 20 years, will undoubtedly remember the first introduction of the so-called radial stay boiler, or what we now call the modern type boiler. You will also remember, I am sure, that all boilers of this design had the rigid radial stays all over the surface of the crown sheet. It was not long until we had trouble in the top flanges of flue sheet cracking, just as I described a moment ago, cracks running from holes around knuckle of flange to rivet seams, margin between flue holes also cracked parallel to top flanges. These results, discovered on practically a new boiler, formed the starting point for investigation as to what was the cause and what could be done to eliminate the trouble. It was finally decided that some release to the upper flange of the flue sheet was necessary, as at that point it was considered the hottest part of the fire box, caused by the excessive heat rising from the fire and ascending to the top of fire box and drawn rapidly through top of flues by the exhaust of the locomotive.

The first experiment was to remove the first three rows of rigid stays and substitute adjustable stays. Results showed an improvement and less cracking of flanges. Not satisfied with this, further experiment was given by substituting adjustable stays for five rows of radials, and still better results were obtained. This was kept up until seven rows from the front were displaced with adjustable stays, and still better results were given. Now, gentlemen, if you noted what I have said, along with the different changes that took place in the removal in the first place of three rows of rigid stays, then five rows, then finally seven rows, at each test receiving better results, you must agree with me that the application of the adjustable stays overcome the difficulty by releasing the terrible strain at top of flue sheet flange by the adjustable stays allowing the sheet to expand upward with ease. On the other hand with the rigid radial stay located on top of crown sheet, submerged in water, spaced four inches from centers, it holds the crown sheet as solid as the steel itself, resisting the expansion of the lower sheets of the fire box, consequently something has to give to expansion, and the weakest part being along the top rows of flue holes underneath the top flange, it was where our trouble began. The Chicago & Northwestern Railway has still bettered the conditions by leaving out a few top flues and allowing a larger margin between the top flue hole and the knuckle of the flange. This has proved to be a good thing, as it provides strength at that point of the sheet and gives assistance to the adjustable stays in taking care of the expansion. In the large, wide fire box locomotive boiler where the tee iron is used in the first four rows from the front flue sheet, we have been able to get better results by oblong holes in the top tee iron, allowing the upright brace, from lower tee to upper tee to adjust itself along with the expansion.

Gentlemen, we should not be in a hurry to pass this subject. It is an important one. It brings us close to the vital point of modern locomotive. We should continue our session this afternoon and further discuss this subject and similar ones for the benefit of all members as well as the good results we may bring about for the betterment of the service and the railroad companies we represent.

Mr. Berry: I think as far as the staying of our sheets is concerned, that it will be impossible to eliminate all cracks from the stays, no matter what flexibility you give them. We have found that better results can be obtained by dropping one row of holes from the top than by any other method. Still we are getting some cracks. I think there is something further than the staying that has to be figured out to overcome this difficulty.

Mr. Lowe: I move that this discussion be now closed; that the paper be received and carried over for another year with a Committee empowered to correspond with the different railways and get their experience, and come to next year's Convention provided with full information to enable us to suggest a recommendation and cure for this evil of tube sheets cracking.

The motion was seconded.

The President: I wish to say that the report has been accepted and the Committee discharged.

Mr. Goodwin: I would like to raise a point of order. There is a motion before the house, but I want to rise to withdraw that motion, because I think we have a good subject and I really think we could spend more time on it advantageously.

Mr. Brown: I move that we adjourn until 1:30 or 2 o'clock. In connection with this adjournment, I wish to say, gentlemen, that we are here to fatten ourselves on this information. Let us be here promptly at the time agreed upon. I have no doubt every member in the room enjoys the hospitality of all the different displays in the building, but let us not lose time when there is other business of importance claiming our attention. I move we adjourn until 2 o'clock.

The motion was seconded.

The President: It has been moved and seconded that we adojurn until 2 p. m.

The question was put and carried unanimously, and the Convention declared adjourned until 2 p. m.

AFTERNOON SESSION.

The Convention was called to order by the President at 2 p. m.

The President: The subject of "Best Methods of Staying Front Portion of Crown Sheets to Prevent Flue Sheet from Cracking" is still open for discussion.

Mr. Goodwin: I understand Mr. Wood put this sketch on the blackboard, and I think it would meet with the approval of the Convention if he would come forward and explain what he claims for this box.

The Chairman: Mr. Wood, please step forward and explain what advantage your method of making the flue sheet has over the other.

Mr. Wood: You gentlemen gave me at the Buffalo meeting the information that this was developed from. I was asked if I would try to do something in the shape of flanging to eradicate the troubles talked of this morning. I claim that this flange —that is, the top sheet—not only increases your heating surface, but it strengthens the flue sheet, and it not only strengthens the flue sheet but it takes out that buckle that was spoken of this morning, in the center, and allows it to expand and contract in unison with the front tube sheet. The front tube sheet is flanged in the same form. These tube sheets should be of identical thickness so there should be no more tension on one than on the other. We have increased the area 50 per cent in the first place. It has five places in which to expand, before it would reach any vulnerable point. The sections we have made 1¼ inch deep. I contemplated making them considerably deeper in the first instance, but I reduced them after making tests on the testing machines. We could elongate that section with 900 pounds 1-20 of an inch and it will go back to its original position every time. You can pull it 50 times and it will go back to the same position. With the same section on a straight plate, it takes 15,300 pounds to elongate it 1-20 of an inch, and after it is elongated, it is permanently set and will not go back. This goes back to its original position every time, which shows the elasticity of the section. It is only an inch and a quarter deep and there is not a great deal of cavity for any sediment to rest in. In working five months we have found no broken staybolts and we find, as I said, the scale which tends to adhere to the plate drops off. We make these five inch centers. By doing so we dispense with 350 stays in a box of the same size, which is an important factor. We increase the diameter of the stays to 1⅛ inches instead of 1 inch. The reverse section is only 13-16. This is open for discussion and I would like you to pull it to pieces in every way. I am very glad to hear that our friend, Mr. Kelly, made a step in the right direction, but when he showed me where he put that stay, I was sorry to see it, because I would have told him not to put it there. I have had a large experience in flanging, and I suppose that is the reason the boiler makers asked me to take an interest in them. I devoted two years' time to the study of it before I allowed my name to go out with it or allowed anyone to see it. It is there for what it is worth. and I think it is the future box. (Applause.)

The President: Any member that wishes to ask any question regarding that flue sheet or its working, has the privilege of doing so.

Mr Goodwin: I would like to ask why you put the crown bolt as it is.

Mr. Wood: Mr. White, the mechanical engineer of the New York Central, wanted me to put in three rows of sling stays, but I didn't see any use of it at all; they might as well be left out. I want to make another statement, that is, in regard to the wrapper sheet. I made the wrapper sheet 1-8 of an inch heavier than it used to be. I did it because I thought I would have 11 threads instead of nine, and that would give my stay a firmer setting; and I wanted my stay to be firmly placed and the bolts do the work of contraction and expansion. I did not carry these corrugations to the bottom because I did not want them to run into where the fire comes. I wanted that to be clean and clear so that no clinkers would get on the corrugations. I claim that these corrugations going down the side assist the circulation of water by making it more rapid, inasmuch as it divides up the column of water in this large box and allows the gases to escape so much quicker. We have not taken up much room. We have not changed the position of the stays in any shape or form; only made them so we could dispense with 350 stays in the box. They are on the flat surface just the same as they were in the flat box. The only thing it does is to place the water line 2 1-2 inches higher than what it was before. As to the safety factor, that complies with the New York State Laws just the same. It not only gives increased heating surface but makes it 50 per cent stronger and takes up that buckle in the center that was spoken of this morning, because you have a stiff plate.

Mr. Connor: Do you claim that that will take considerable of the rigidity off of the bead of the flue?

Mr. Wood: I consider that there should be a good deal less trouble with the flue, especially if both flue plates are made of the same thickness, so they can work in unison. The tendency of the tubes to expand must go towards the fire, and in doing so you see they can both come together; there is the same leverage on both sheets.

Mr. Connor: The back sheet?

Mr. Wood: Yes, the back sheet.

Mr. Connor: What s the idea of that?

Mr. Wood: That offers a little resistance which ought not to be. It ought to be perfectly equal. I want to get the contraction and expansion right from the front tube plates to the back, and in that way you get better results and you cannot get them without that. The box as made has been simply increased in stayng qualities as the pressure has been increased. Practically the boiler is just the same today as it was when I was a boy, riding on the engines as they went out on the Northwestern Railway in England, as I told Mr. Hoke and Mr. Keisel, when they said they had been studying 12 years to better their boilers, and I said "You have made worse inasmuch as you have put in more stays as the pressures increased, and every stay makes the boiler worse."

Mr. Connor: By making that back sheet heavier than the front, don't you claim the resistance is greater on account of it?

Mr. Wood: I claim the resistance on the sheet (referring to drawing), would be greater than it would on the front plate, and it would not allow the tubes to go in harmony.

Mr. Connor: Consequently it would be more severe on the bead.

Mr. Wood: More severe on the bead, exactly. There really ought to be very little trouble with this box, because you can see the points that would take care of the expansion before it will attack any vulnerable point. This blue print shows the flue sheets of the boilers of this kind run on the New York Central. They have run five months, and I get a report from the locomotive expert every morning when I am home. I have a report of all three boilers. I believe you can make this box as cheap as you can make your box with plain sheets.

Mr. Wheeling: I understand that some of your boxes have been used.

Mr. Wood: We have only three.

Mr. Wheeling: Where they are used, what result have you had along the line of flue failures or cracks?

Mr. Wood: We have only run them five months. There is not a shadow of failure in any shape and not a broken stay. I suppose most people are conversant with water on the western division of the New York Central. It is very bad between Syracuse and Buffalo. It occurred to me that in boilers using the steel flue sheet, charcoal iron tubes, and copper ferrules, that there might be a very heavy galvanic action set up by the properties in the water and the copper and the consequences would be it would affect the tubes to some extent. I suggested a remedy that might eliminate this trouble.

Mr. Wheeling: Do they have any trouble with leakage?

Mr. Wood: Yes, they have trouble all the time.

Mr. Wheeling: With this box?

Mr. Wood: No, they have been running against engines of same capacity, the boilers of which have larger fire boxes, and according to their report we don't burn any more coal for the same work than the engines referred to; therefore, it shows the balance is in favor of these engines with boilers fitted with my fire boxes and tube plates. We find that on account of the increased fire box surface we can leave the doors on the latch all the time, blowing off steam from the time they leave Buffalo until they reach De Witt.

Mr. Connor: The same size boiler?

Mr. Wood: It gives you about 23 per cent of extra surface in the box. That is, you get 610 square inches extra area on the fire box tube sheet.

Mr. Connor: Do you mean to say they require less fuel than larger sizes?

Mr. Wood: They have been running these against engines with boilers that had 20 inches from the grate to the brick arch, and which were fitted with brick arches and ours had no brick arches, and still our boilers were blowing off steam all the time. There is no sign of any giving out or leakage at all. Our box has only 5-12 inches from grate to arch tubes.

Mr. Connor: No leaky mud ring?

Mr. Wood: No leaky mud ring at all.

Mr. Connor: What is the radius?

Mr. Wood: (referring to another blue print of Mogul fire box) It has a regular mud ring with a small radius, I suppose the flange is 1 1-4.

Mr. Goodwin: I have measured it and find it is 1 1-2, that is the thickness.

Mr. Wood: That is the thickness, but it has the regular radius. This used to be a flat box. That is the outside line of the corrugation there (referring to blue print of Mogul fire box).

Mr. Connor: Is your back sheet corrugated at all?

Mr. Wood: No, it has to be strengthened.

Mr. Hemphill: I would like to ask a few questions in regard to the cracking of side plates and later on as to the cracking of the plates on top. In fire boxes longer than 72 inches, in tramming them, you will find that the expansion only runs 36 inches from each end and in the center of the box it has a tendency to buckle. It is held that there is great stress put upon the plates while they are hot. Now I hold that this is not true. There is no tension there, but there is a compression, and the compression shoves the metal in and it turns upward forming a bulge.

Mr. Wood: You have all these tubes acting as a stay. Therefore, it is, as you say, a compressed strain there.

Mr. Hemphill: If there is no tension and there is a compression in here, your idea is to eliminate that by the corrugation?

Mr. Wood: Exactly, and I do so. I want the stay to remain permanent and I want that plate to be perfectly free to move. I don't care about this (referring to the drawing), because it forms an abutment like the abutment to a bridge.

Mr. Hemphill: With the old style box, the cracks would be this way.

Mr. Wood: Yes.

Mr. Hemphill: With this style box the cracks would be this way if it cracked at all.

Mr. Wood: I don't see how they can crack that way. Of course, we have had no experience up to this time. When the expansion is this way, there is a corresponding contraction in this place (referring to the drawing) that will equalize the direct expansion throuhgout the box.

Mr. Hemphill: More than a year ago when I received a set of these drawings I sent an order for one of these boxes. I think Mr. Wood got fairly along with the order when the financial crisis came up and it was held up. What we have now will not eliminate the cracking of the flue plates on the top, and it is possible that Mr. Wood's idea will eliminate that, and it is also possible that the corrugations will eliminate the cracking of the side plates. As he has stated as far as the mud ring is concerned, it comes down too low and is cold and there is no great expansion or contraction. The mud ring will not work either way with the corrugation so close to the mud ring. But the subject we are on now is the top sheet.

Mr. Wood: We have increased the sectional area of that 70 per cent.

Mr. Hemphill: What method can we employ to prevent that cracking?

Mr. Wood: I don't think you can employ any better staying than that. (Referring to the drawing.) I am not very much in favor of the tee iron and the stays the same as you use in the Atlantic Type or the Pacific Type. I think this (referring to the drawing of the New York Central Consolidation Type of Boiler) is a most beautiful form of box to make and to do good work. I don't hesitate to say there will not be a broken stay in that box in a year.

Mr. Hemphill: Now, so far as the cracking of these plates is concerned, there is only one way to get away from it. It is to redesign the plate. This might possibly do something towards eliminating that, but I doubt very much whether it will wholly overcome it. However, as I said, I was willing to try one of these boxes and see.

Mr. Brown: Do I understand Mr. Wood to say that his corrugation is a new device?

Mr. Wood: Well, as far as I know.

Mr. Brown: I refer to the side sheet.

Mr. Wood: Well, this is the crown and the whole business. Professor Hutton of the Society of Mechanical Engineers, in his new work, gives me the credit of being the inventor of corrugating the plain elements of a complete fire box.

Mr. Brown: I refer to the side sheet alone.

Mr. Wood: The side sheets have been working on the Chicago & Northwestern, and side sheets were used some 30 years ago, I have been told by Mr. Wells. But while the corrugations did remarkably well, he did not have them in the proper form. In other words, there was an acute angle which caused them to crack at the angles. There is no angle in this form at all. I studied on this formation two years before I would allow my name to be associated with it. I have a pretty good reputation for my hydraulic machinery all over the world, and I would not let that go out unless I knew it was right.

Mr. Brown: I appreciate that part, but since you have mentioned Mr. Wells, we have another man here that served with me under him, Mr. Denzler of the Pacific line. I served my time under Mr. Reuben Wells, and in the railroad world he was at the top round of fame.

Mr. Wood: That is right.

Mr. Brown: But he fell when he put the corrugation in. Reuben Wells in his experience as Master Mechanic on the J. M. & I. worked from Louisville to Indianapolis and got this idea of corrugation in the side sheet. I have the pleasure to say that I was one of the men that formed the sheets for him. The distribution was between two rows of staybolts, between every corrugation. This was in an O. G. fire box and all he asked for was the corrugations to extend a reasonable distance above the side bearings to an approximate point in the corrugations. I know that Reuben Wells would rather not have suffered that defeat. His side sheets were only in service a very short time.

Mr. Wood: I have his own handwriting for it.

Mr. Brown: He had a patch on every one, with the exception of those adjacent to the flue and door sheet. I want to show you where Mr. Wells got his idea. He wanted to find out the difference in expansion at the different points of this fire box.

Mr. Wood: Show us the section, Mr. Brown, please.

Mr. Brown: We will call that a tunnel groove or mitre. Each one of these plates were placed so they would be male or female. Just opposite this he put a large board, possibly 12 inches wide, and on this he put several little fingers. Those were adjustable. From every plate to this he had a small centered bar, in that manner, to each individual one. You will understand there was a little screw in there for a fulcrum.

Mr. Wood: What was that to do?

Mr. Brown: To get the expansion. This would represent a vertical water space. At one side of that he built a fire, as intense as he could get it, in order to get the full expansion of those plates, and to see what relation this had to this, etc. Mr. Wells' conclusion was that he would try corrugated side sheets. I think Mr. Densler will bear me out in this, that Reuben Wells had to acknowledge that there was a mistake in the corrugation.

Mr. Woods: Tell me how Mr. Wells flanged his plate?

Mr. Brown: He made a male and female tie. While this was a quarter of a century ago, it is as clear in my mind as though it were only yesterday.

Mr. Wood: Mine are not like this. This is the drawing he sent to me (making sketch) and it came right down to the mud ring. That must be another one.

Mr. Brown: I would like to ask Mr. Wood if this corrugation is perpetual all around?

Mr. Wood: Yes, sir.

Mr. Brown: I fail to comprehend where the expansion will go to.

Mr. Wood: It will go just as shown here. (Referring to drawing.)

Mr. Brown: That is a perpetual circle, is it not?

Mr. Wood: It contains the whole nest of tubes.

Mr. Brown: I fail to see where that provides for the expansion, from the fact that this is a circle here. I am a little slow in comprehending the good things about it, I guess.

Mr. Wood: That is right, Mr. Brown.

The President: Mr. Brown, Mr. Wood wants to demonstrate that the buckle will be taken care of, which is caused by one part of the box expanding more than another.

Mr. Wood: It goes two ways.

Mr. Brown: Up is the question we are discussing.

Mr. Wood: It goes up here. (Referring to drawing.) That liberates it from here to here.

Mr. Brown: This corrugation is continuous and I fail to see where the outlet is.

Mr. Wood: That is so much the better. It allows it to go both horizontally and vertically.

Mr. Smythe: We would be very glad to have Mr. Wood to explain that boiler any time after the convention hours. We have worked very hard this morning and our work has been very profitable to some of us. I have heard somebody say that we are spending too much time on one subject. Would it be in order to move that we proceed with the business of the Convention? I move that no speaker exceed five minutes, and that he must ask permission of the chair before speaking a second time.

The motion was seconded.

The President: The motion before the house is that we continue the discussion of this subject, limiting the time of each individual to five minutes on the first occasion, and no one to speak on the subject a second time without the permission of the chair.

The question was put and the motion carried unanimously.

Mr. Gray: In regard to that corrugated flue sheet, I don't see that it will eliminate our trouble a particle. We get the same result in that flue sheet that we get in the front flue sheet. Our front flue sheet cracks around the heel of the flange, around the bottom. There is another development in the front flue sheet different from the back, and that is easily explained by the fact that the front flue sheet never gets any work done on it only when we are resetting the flues. The back flue sheet is being continually worked and the flues expanded, and in my estimation the corrugations would give out there sooner than the ordinary straight flue sheet.

Mr. Laughridge: It has been my experinece with corrugation in fire boxes that the life is limited, no matter where you put the corrugation. You may put it vertically up and down the end of the side sheet or the center of it, and connect your crown sheet and flue sheet together, but they will break. At our morning session a gentleman explained that he flattened a flue sheet at the top and then flattened the crown sheet to accommodate it. I had an experience with an engine very similar to that. I did not want to renew the crown sheet, I was just renewing the flue sheet, and I flattened the flue sheet and dropped out 14 flues, putting O. G. down from the crown sheet to the flue sheet. The O. G. broke at the corner.

The President: In other words, you were making allowance in the crown sheet for the expansion upwards.

Mr. Laughridge: My idea was to ge a flat surface and get rid of this extra metal or rise of the flue sheet. The flue sheet did not break. The object was to see what it would do, as an experiment. That sheet finally broke because it provided a place for the expansion and contraction to exert itself. The same thing may be said of the side sheet, if you corrugate it as Put your staybolts in here. As Mr. Hemphill has said, when the sheet expands the metal is under compression, but it is when it contrasts that the mischief is done. When it contracts, the sheet breaks on the fire side in the compressed surface and cracks on the water side in the convex surface. A sheet will corrugate itself naturally in a bad water district to some extent. I have seen a side sheet corrugated from the O. G. down and I have cut a great many of them out. I never saw any that were not folded or cracked through between every row of staybolts with the exception of the row next to the door or the row next to the flue sheet. They would sometimes stay all right.

Mr. Wood: That was simply a corrugated side sheet. It was not a complete box.

Mr. Laughridge: No. In this flue sheet that would either break here or there.

Mr. Wood: No, I don't think it will ever break there. We will let you know when it does break. We will have it brought to the Convention so that we can see it. It has five places to relieve itself before it reaches any vulnerable place.

The President: Your five minutes is up.

Mr. Kelly: I think I should say something about this corrugating of side sheets in a locomotive fire box, and I won't take five minutes either. If two and one-half years' experience will not prove corrugaton on the top of back flue sheet a good thing, what will? I think the corrugated crown sheet will bank up with mud and crack and so will that. There is no question about that. I don't agree with Mr. Wood about placing the staybolts in the top of the corrugations. I think they should be in the bottom.

Mr. Wood: You are wrong. That is where they will crack.

Mr. Kelly: The staybolt head, when it is in the bottom of the corrugation, is protected from the fire and on the top it is in the fire and will always leak.

Mr. Wood: They are always in the fire.

Mr. Kelly: But they are protected at the bottom. The water is closer. I want to tell you, gentlemen, we are corrugating all the sheets on the Northwestern, and I don't know what Mr. Brown has on Mr. Wells in comparing the straight side sheets with the corrugated. We are corrugating all our side sheets from above the O. G. to the sidebar with a 3-4 inch radius with the staybolts in the bottom. This was applied on the first engine five years ago. That engine, previous to that time, cracked a set of sheets in 10 or 12 months. The corrugated side sheets on engine 339 are still running. All engines at the works are corrugated. I don't say that corrugated sheets will not break. Of course they will. I rise to defend the corrugated side sheets. Mr. Wells left a flat surface here. He should have put a corrugation in every staybolt. Mr. Hemphill brought it out plain enough, that there is a tension on the sheet there and the corrugation will take care of it. On bad water divisions the straight sheets come out every nine or 11 months. I think I ought to advocate the corrugated side sheets, because the Chicago & Northwestern had corrugated side sheets and had the crown sheet corrugated 35 years ago.

Mr. Brown: What caused you to remove the straight side sheets?

Mr. Kelly: They were cracked and that is the reason we removed the corrugated sheets too. Our staybolts never leak in corrugated side sheets, but when they were straight side sheets, they leaked all the time. With the few corrugated side sheets we have removed, the stay bolts were just the same as when the sheet was put in. I take the stand of advocating the corrugated side sheet against the straight side sheet and think Mr. Wood's fire box has good points and should not be turned down too quick.

Mr. Brown: Do you admit that the corrugation will crack, but will protect the staybolt?

Mr. Kelly: It certainly does prevent leaky staybolts.

Mr. Brown: You do not mean to recommend a cracked corrugation in protection of staybolts?

Mr. Kelly: No. I believe in recommending anything that will inprove conditions. If others have failed in corrugating side sheets it does not follow that it cannot be done successfully.

Mr. Brown: The corrugated sheet will crack?

Mr. Kelly: Anything you put on a locomotive will crack.

Mr. Brown: You remove the side sheet to prevent the staybolt leaking?

Mr. Kelly: No, they come out because they are cracked and patched. The staybolts don't leak up to the time they are taken out. We are putting corrugated sheets on all engines that come from the works. Gentlemen, when you can show a railroad that you can increase the life of a side sheet two to one, you are showing them that you are saving them some money and as the corrugated sheets will run as long as the straight side sheets, I will always recommend them, as I know postively the staybolts do not leak and blow all over the fire, a condition that means a greater consumption of coal, one of the greatest costs of railroads to-day.

Mr. Smythe: The convention is considering flue sheets and we are now down to side sheets. We will never get any business done at all. It is true that boiler makers are very enthusiastic when it comes to talking about boilers. I heard yesterday morning that two of them were down in the basement floor drawing a boiler. (Laughter) I move that we proceed with the subject that is before the Convention.

Mr. O'Neill: I have had a great deal of experience with corrugated sheets. Some years ago I experimented a great deal on corrugations and depressions, and when I went on the Chicago & Alton Railway, I met a man named Holland, who also had experimented for years with corrugated sheets. I found that some of his sheets had been in for a number of years, and my attention was called to them. I considered he was moving in the right direction. I experimented on a little depression in a corrugation shape. It was more of a corrugation than anything else. I put in as high as 85 fire boxes on that road, all corrugated or depressed. I corrugated some of them in the crown sheets, and some of them gave good results I understand. I also put corrugation in without staybolts in large patches as high as 36 inches square. We were using a high grade of steel—65,000 T. S. I could get none of the steel merchants to come down to my idea. I suggested a steel with 48,000 tensile strength but I could not get any one to agree with me at the time. I wrote to the Carbon Steel Company asking them to make this steel. I figured by getting a low-grade steel I would have all that was required for elongation and ductility. I proved that to my own satisfaction by putting in large patches depressed without any staybolts. After running those patches for some time I found that some of them had cracked. I knew what was the cause of it, the steel was 65,000 pounds tensile strength. I then put in steel of 48,000 pounds—had it made on purpose, and tried that. I also had steel made that ran up as high as eight cents a pound called nickel steel. This steel was given some treatment which I do not remember now. It was dipped in some kind of oil, and was reduced to 48,000 pounds tensile strength. In testing the steel I used to bend it over a block ¾ radius, and bend it four times backward and forward, and if it did not give way, I put that steel in the fire box. I put in 22 fire boxes with the depressions of this low-grade steel with good results.

Mr. Brown: By "low grade" you mean low tensile strength?

Mr. O'Neil: Yes, low tensile strength. If you are going to use depressions or corrugations, high tensile strength steel is wrong, as the higher the tensile strength the more apt are the sheets to crack. The depressions and elongations will make up the difference between T. S. of 65,000 and 48,000 pounds, as they strengthen the sheet 25 per cent.

Mr. McKeown: Some years ago the Pennsylvania Railroad tried this corrugation arrangement in the crown sheet, but we put our braces in different. We put on crow foot braces, riveted on like this and put them on the high part. We had trouble in the hard water districts because they filled up in the low part. We also had trouble due to cracking in the high part of the corrugations. I would like to ask Mr. Wood how long this fire box has been in service.

Mr. Wood: Only five months.

Mr. McKeown: We will see you later on. (Applause.) The cost of repairs is going to be great to keep them going. The cost of quick repairs is something we have to keep in mind.

Mr. Wood: We have not had any trouble so far.

Mr. McKeown: I hope you will not, but we will see you later on.

Mr. Walker: I would like to know what subject we are on, whether we are discussing crown sheets or putting in corrugated fire boxes.

The President: I will explain that. We took up this subject to give a certain time to it. That includes the side sheet and crown sheet and all.

Mr. Brown: This disease is contagious.

Mr. Walker: If this is an experiment, we ought to wait until we have experimented a while longer.

The President: We gave Mr. Wood the privilege of explaining his sketch.

Mr. Walker: We people who have trouble with cracked flue sheets would like the people who have a great deal of experience along that line to tell us what to do; and if we get through with that, we will talk about this.

Mr. Wood: This was put in by the New York Central and I found it overcame the difficulty of cracking flue sheets.

Mr. Patrick: Your Committee on Rules and Formulae is ready to report and would like to have a time set.

The President: The Committee on Boulevard and Formulae is ready to report. What is the pleasure of the Convention?

Mr. Hemphill: I move it be taken up when this discussion is closed.

Mr. Wheeling: I second the motion.

The question was put and the motion carried unanimously.

The President: Mr. Patrick, in about 15 minutes.

Mr. Laughridge: We have put in about three hours on this subject and I move that the discussion be closed.

The motion was seconded by several members.

Mr. Brown: Before you put that motion, I observe Mr. Densler is here, and I want him to corroborate my statement with respect to corrugations 25 years ago.

Mr. Wood: We don't doubt what you say is true, but we do doubt that the complete box was formed in that identical way, whether you had the tools to do it with that we have today, and whether you annealed it.

Mr. Brown: We did anneal it. This seems to be up as a new question. It was tried 25 years ago, and if it would break then I would like to know why it will not do so now.

Mr. Wood: Mr. Brown, will you kindly tell me why the Fox furnace, which is corrugated, has been such a great success in marine boiler work?

Mr. Brown: I am not familiar with that.

The President: I put in corrugated sheets years ago and 1,800 to 2,400 miles was the best I could get out of them. As Mr. Kelly knows, we can prevent the staybolts leaking to a certain extent, but that is the only good I could get out of them.

Mr. O'Neil: What tensile strength were you using?

The President: About 50,000 pounds at that time.

Mr. Wood: Mr. Conrath, how did you flange them?

The President: We corrugated them with rollers, by putting bars in the roller and squeezing them and annealing them. If we cannot bring the steel back by annealing, it is not proper steel.

Mr. Brown: I move that this Committee be extended another year.

The President: The Committee was discharged. The motion before the house is that the discussion be closed.

A vote was taken and the motion carried unanimously.

Mr. Wagstaff: I move that this subject be continued another year.

Mr. Brown: Second the motion.

Mr. President: The motion before the house is that the subject be continued for another year.

Mr. Brown: And a Committee appointed.

Mr. Wagstaff: If I am in order, Mr. President and gentlemen, I would like to indorse that motion. If the Committee will extend their inquiry outside of the railroad shops they will find that some very good suggestions can be obtained from the American Locomotive Company on this very important subject. The Inter-Colonial Railroad have an application of staying the crown sheets that is worth considering. The Master Mechanics' Association sought for about three years to thresh out a boiler design and at the end of that period they asked for an appropriation to turn the subject over to a scientific college.

The President: It would not be necessary to put the motion at all as we have a Committee to select suitable subjects for next year's Convention.

Mr. Gray: Mr. President, I do not dislike the way the motion is put, but it seems that we have done about all we can on the method of staying crown sheets to prevent flue sheets from cracking. I suggest that a new Committee be appointed to suggest methods to prevent flue sheets from cracking at the top, leaving out the bracing.

Mr. Lucas: As one of the Committee on that question, I believe we reported that there was no best method. Just as long as we use an expander and continue to expand flues, just so long will we have the flue sheet go upward, unless we design some new method of applying flue sheets, or fire boxes.

The President: We are after a Committee to investigate and find out what causes the flue sheet to crack and then recommend a remedy.

Mr. Lucas: I believe every boiler maker in the hall knows what the causes are.

Mr. Young: Mr. Wood has a fire box on the New York Central in this form in service. I believe it will be well for each and every one of us to keep tab on that fire box and see what the performance is. By next year we will know whether it is good or not.

Mr. Fisher: We have reports from every locality in regard to cracking of flue sheets, in fire boxes that have been in service for a short length of time and in fire boxes where the flue sheet had been abused by the use of the expander as Mr. Lucas says. We have the best water I believe there is in the country, and flue sheets crack before the flues are expanded to such an extent that the expansion is the cause of breaking. There is one particular engine that I have had trouble with, out of a class of which we have five. The flue sheet was giving more or less trouble all the time and finally cracked. I investigated and found that the water glass was placed in such a position that there was only one inch of water over the flue sheet at the time the water showed in the water glass. After the water glass was changed this engine gave no more trouble. This man on the road that runs from Houston to New Orleans strengthened my theory, for the reason that he showed a flat tube sheet or flue sheet, lower down. He flattened the sheet, and in my estimation he gets a larger volume of water on top of his flue sheet and consequently prevents rapid crystallization. I believe, and it has been demonstrated and tried, that a locomotive will leave the water over the crown sheet when the throttle is opened rapidly. I believe there is not a large enough volume of water over the flue sheet to prevent crystallization.

The President: Your idea is that an engine working hard will keep water away from the flue sheet?

Mr. Fisher: My idea is the engineers do not carry enough water to keep the flue sheet well covered when making runs to get over hills, or when running engines that are steaming poorly, and take hazard chances over the road.

To the President, officers and members:—

Your Committee on Boiler Rules and Formulas for calculating strength, strain, working capacity, etc., for steam boilers, or other kindred vessels working under pressure and also other subsiderary items, submit to you through their chairman's composite report the following rules for your consideration and adoption.

Of the several rules and formulas brought to your attention for consideration preparatory to our next convention, it may be said that there are three classes under which these rules are classified and which we recommend.

First—Those rules for the calculation of weight against resistance, which embraces cylindrical sheels, the strength of riveted joints, dished heads, strength of ligaments between tube holes, the shearing strength of rivets in single and double shear, etc.

Second—Those rules or formulas established from one or more tests where constants are given to work from, such as fire flues, furnaces and truncated cones subject to external or collapsing pressure.

Third—Those rules established because of common practice and accepted by Boiler Makers and Engineers, though not substantiated "so far as we know" by other than comparisons to somewhat similar action of metal subject to somewhat similar strain, such as staying of flat surfaces by screw stays or otherwise.

In the way of explanation under the first class items, plates may be pulled and rivets sheared in testing machines to ascertain their resisting strength and from these weights total resistance may be found to balance weight of force, hence "after good workmanship of joining together" becomes only a matter of calculation, which may be relied upon.

Under second class items established formulas are used; while some have been arrived at by actual tests which may be relied upon, others are yet to be experimented with, or tested out before accuracy is ascertained; however, we accept such latter rules as sufficiently correct for use in the absence of actual tests bearing upon the various portions in question and also because of the fact that no serious accident can be traced directly to their use.

Under third class items, you have for your consideration formulas accepted and used by the U. S. Government, the State of Massachusetts and the British Government.

The graduating formula by Mr. T. C. Best worked out from that used by the U. S. Board of Supervising Inspectors, and was intended to and does show the incorrections of the rules used by them.

The formula recommended by Mr. D. K. Clark, also regulating formula closely approximating the formula of Clark, suggested by the Chairman and recommended for use by the Committee until such tests are made to prove it incorrect.

We see no reason to call your special attention to any of the rules coming under the first and second class, but do request that every member of the Association study the tables and rules given in this report on the staying of flat surfaces coming under the third class. Additional tables worked out from other formulae than those used, may be submitted to the Committee together with your comments on same, in order that we may be fully informed as to every rule of sufficient consequence or importance to command our attention.

Should you differ from the recommendation of the Committee, tell why; should you find any mistakes in this work, notify the Chairman at once should you know of any simpler, plainer or shorter one to arrive at the same result, we earnestly urge you to put it in form and mail it to us. Do not wait until the opening of the Convention for there may be a hundred such improvements suggested which would require more time than could be allowed the various subjects at that time.

Any suggestion as to safety appliances to be attached to vessels working under pressure, or method and frequency of inspection, also other important work in connection with the subject in hand, should be placed in writing and sent in, for consideration of your Committee before it is brought to the attention of the Convention.

While it is not the purpose of your Committee to go into the history of the steam boiler, it may not be out of place to mention here that steam boilers were made and used over two thousand years ago. The common lever safety valve was used on steam boilers over two hundred years ago; yet in some sense we are unable to state positively why and for what reason we use some of the rules which guide us in constructing. However, it may also be said that since the formation of our Association many matters along these lines which once seemed to be beyond the comprehension of the ordinary man a few years ago are now looked upon by many of us as a simple problem, to be worked out in an ordinary manner.

The constant study along scientific lines in conjunction with the everyday practical use of the knowledge gained will eventually force a more thorough understanding of all matters pertaining to our work.

Points essential are selection of the very best material, proper proportioning of all parts, and the best possible construction.

The factor of safety should never be less than that recommended in the following rules, and as the boiler grows weaker with age, it should be carefully inspected by a competent and practical Boiler Maker, and the pressure reduced proportionate to its weakness. We can fix a factor of safety when a boiler is constructed new, which would be allowed at its installation anywhere in the world a stipulated amount of working pressure, though cannot specify how much to reduce this pressure each year, or five years as it is impossible to determine the deterioration under the various conditions of usage. Could this be done we would make the calculations, put them in book form and provide every boiler maker with a ready boiler inspector that would insure the safety of the public so far as boilers are concerned.

We aim to adopt the best rules, place them in the hands of capable men who are familar with the construction. men who are able to judge from their practical shop experience the conditions of such recepticals upon personal inspection.

It is not expected that this report will meet the approval of all; we invite and expect criticism, and by your criticism we hope at the close of our Convention to find ourselves a few steps closer to the goal of perfect rules and formulae which we may look to as the guiding star of safety.

[Rules and formulae as adopted will be published in pamphlet form and sold by the Association.]

The President: The next order of business is the report of the Committee on Rules and Formulae. That was my mistake

Mr. Patrick: Will you read this?

The Secretary read the report, as follows:

To the Officers and Members International Master Boiler Makers' Association:

We, the Committee on Rules and Formulae, appointed at this Convention, have been fully over the report as contained in typewritten matter, and recommend for adoption the rules and formulae as specified therein. Also suggest or recommend that all matters contained in this report be printed and copyrighted in any form and for any purpose you may deem consistent and advisable.

CHAS. P. PATRICK,
H. L. WRATTEN,
H. J. RAPS,
C. E. LESTER,
C. J. MURRAY.

Mr. Hemphill: I move the report be accepted.

Mr. Gray: I second the motion.

The President: The motion before the house is that the report be accepted and the Committee be given a vote of thanks.

A vote was taken and the motion carried.

Mr. Best: I move that the chairman of the Committee be reimbursed for the expense he has incurred in compiling the report and having it typewritten.

The President: That is not necessary. We will take care of that. If any member has incurred any expense, I want him to put in a bill and it will be taken care of. These rules and formulae, I believe, should be embodied in a small book of pocket size, and it will take a little money for the printing. I believe it would be a good idea to have a Committee appointed to take care of that. Each member might be assessed to defray the expenses of printing, or possibly we may be able to furnish the money out of the treasury, in which case we might sell to outsiders for a certain price, say 75 cents or a dollar.

The Secretary: To my mind this seems of great importance to the Association, as well as to the individual members. It has occurred to me that to print the report of the Committee on Rules and Formulae in the official proceedings would deprive the Association of a source of revenue. It seems to me that, being finally adopted, the report should be copyrighted, and issued in pamphlet form, to be sold at a certain figure to members of the Association, and at a higher price to outsiders. In this way you prevent anyone appropriating the results of the excellent and untiring work of your Committee. According to your Constitution and By-laws, this matter ought to be referred to your Executive Board, the Association to decide as to the manner of publication.

Mr. Laughridge: I move it be referred to the Executive Board with full authority to act.

The President: We want the Convention to decide how the rules and formulae shall be published.

Mr. Laughridge: If they pass on this motion it puts it up to the Executive Board.

The President: Do you wish to give the Executive Board the authority?

Mr. Laughridge: That is it.

Mr. Wehling: Do I understand that this Association adopts these rules and formulae without each and every member of the Association having a chance to know what they are. I don't believe that is fair.

Mr. Laughridge: Mr. President, the member is out of order. The report has already been accepted.

The President: Mr. Wehling, the report has already been accepted. If these rules and formulae are not what you like, the Committee can be recommending changes all the time. We endeavor to put an advance printed copy of this in the hands of each and every member, but it required $100, and we did not have the money to spare. The report has been handled by two Committees, and the second Committee reports that the rules and formulae are all right. I don't see what more we can do.

Mr. Smythe: I move that this report be printed in pocket form, and, as our Secretary suggested, that the Executive Board have authority to arrange the details.

The President: Did you wish to distribute these books free to each member?

Mr. Smythe Leave that to the Executive Board.

Mr. Laughridge: Under our Constitution and By-laws the Executive Board is responsible for raising the finances, and they are responsible for contracts.

A vote was taken, and the motion carried, the President voting "No."

The President: I am after the sources of revenue. I have had trouble myself that way during the last year and I wanted to protect the incoming officers against it.

Mr. Wehling: I don't want the Association or the Committee to understand that I find any fault with the report. I don't mean to refer to their ability or their fitness in the least. I only took the view that the Association goes on record adopting rules and formulae without letting the membership know what they are. I did not understand that the Association adopted the rules and formulae, but just accepted the report.

The Secretary: Mr. President, in view of the statement you made, it seems to me this ought to be on the record perfectly straight so there may be no misunderstanding, and that the work done by the Executive Board and the Secretary may be satisfactory. The President said he voted "No" because he wanted this to be a source of revenue to the Association. If I understand the matter correctly, in referring this matter to the Executive Board, it leaves to that body the details of copyrighting and publishing this report, and deciding on what prices will be charged to members and to outsiders. It is the property of the Association, and if any revenue or profit is to be derived, the Association will get it.

REPORT OF COMMITTEE ON CARE OF FLUES AND TOOLS FOR SAME.

The President: The next order of business will be the "Best Method for Caring for Flues While Engines Are on the Road and at Terminals, and Best Tools for Same. Mr. Doarnberger, I believe, is the chairman of the Committee and we would be pleased to hear from him.

Mr. Doarnberger: Mr. President and Gentleman of the Convention—Undoubtedly all, or at least many of you, have read and are familiar with the advance printed copy of this report. I have not come before you with any idea that it will receive the hearty approval of all members present, nor that it is to be adopted and recommended by this Association, as a standard, because we are at this time, as at all of our previous Conventions, widely separated on the flue proposition, each having his own method of applying and maintaining flues. It is like the old saying, and a true one, too, "No one's baby is like your own."

This subject as originally assigned to your Committee covered investigation and report on:

> "Best method of applying flues; best method for caring for flues while engine is on road and at terminals and best tools for same."

Although this can be but taken to mean the complete operation, embracing the details in the application and maintenance as well, your Committee, after no little deliberation deems it proper to ask your indulgence by being allowed to depart somewhat from the customary procedure in the preparation of reports on this subject, feeling that it is such a broad one, permitting of so wide a study, that they would be quite unable to do it justice in any comparatively limited report, and they can but hope to interest you by devoting their effort to a detail. Instead of considering the numerous operations entailed in the removal and replacement of a flue in its entirety, together with the various methods of terminal treatment for its maintenance, as has been the custom heretofore, we hope to confine ourselves to the consideration of the bead at the fire box end of the flue, its value, security and endurance under service conditions, including its life under the various forms of shop treatment having been especially attracted thereto, as it seems to be one of the most important features in locomotive boiler work. The practice of setting flues, gauge of material and the maintenance of same, all carry with them their importance, each permitting of the greatest amount of study; and it is curious to note that after all the methods employed seem to be quite uniform throughout the country and vary between narrow limits. This statement can be supported upon referring to many of the proceedings of previous Conventions as well as to some of the numerous articles appearing in the different mechanical journals.

Our study is being directed to the head, because it seems to us full of interest and one of importance, particularly so on account of the endurance of the material of which it is formed, the effect of the working under different tools, together with the result of the range of temperatures. No one, we feel sure, will take exception to the statement that the bead at the fire box end of the flue is surrounded by as many structural limitations as any part of the boiler. The question has frequently been asked and considerably discussed with a view of ascertaining a reason for the existence of the bead and the query is bringing forth widely different opinions. One school ascribes to it a certain amount of strengthening and otherwise bracing of the fire box flue sheets, together with what is obtained by perfecting a more substantial joint; another claims that the bead is a necessity for the reason that it prevents that portion of the flue projecting through the sheet burning off. We are scarcely ready to challenge the latter theory although it seems almost a paradox. To say that the bead is turned over on the end of the flue to prevent it from burning off would seem to be more correctly argued if it were said that the stock of material is turned over to be burned off by the impinging flames thus protecting the material and underlying joint it covers.

While we have not been able to secure a decided balance of opinion for either of these theories, there is still another idea, and not without its champions, that the bead does not essentially maintain the initial relation of the front and back sheets. It is not disputed that a beaded flue is not stronger in tension than if the bead were left off; but still it would seem difficult to explain the existence of the bead on the score of increased stability when we pause for a moment and consider that while we are putting the bead on the fire box end the rolling process concludes the operation in the front end. Admitting the fact that the back flue sheet is subjected to decidedly more severe conditions than the forward sheet on account of the extreme variations in temperature, we must remember that the front flue sheet is carrying equally the same amount of pressure per square inch as the sheet in the fire box; still the ends in the front flue sheet are simply rolled making no attempt whatever to bead them over. We might therefore reasonably assume that the bead is of but little value in supporting and protecting the sheet against sagging and bulging.

This brings us to the consideration of the endurance of the bead. While it is true that the bead is gradually wasting away by reason of the impingment of the heat from the fire box gases, it is also true that not only are particular forms of tools responsible for certain developments, but quite an equal amount can be attributed to the manner of their manipulation. We refer to the bead wasting away because its vitality is gradually decreasing. It may possibly appear under certain conditions that the bead is growing larger but the stock is being drawn from the body of the flue. It might be well to here touch upon the difference between the effect of the roller and the prosser; the difference in the effect of the prosser with and without the boss, also the effect of the beading tool. It is not our purpose to dwell upon the tools, as the subject as given us first implied, but it is simply our desire to direct attention to the result of a number of experiments which seemed to indicate very conclusively that while there was possibly a little difference in the ultimate life of a flue when rolled as compared with one prossered, it was found that the roller had the decided effect of drawing the bead from the sheet, making it necessary that the stock in the bead be again closed down, by hand or otherwise, to again lay it up to the sheet. The tendency of the flue to draw is not entirely absent under the prosser but possibly less pronounced. It is also a fact, we believe, that a prosser, at least those made with the boss, can only be used for a certain period during the life of the flue. This is not true of the roller nor of the prosser where the boss has been left off. Where the bead is decreasing in size judgment must be exercised in the use of the beading tool to prevent guttering of the flue sheet. It also requires judgment to decide just how long this latter tool can be used before it has to be given up entirely for the roller. This, of course, obtains during the latter portion of the life of the flue. It is quite possible about this period in the life of a flue to sacrifice flue sheets for flue beads on account of the manner the flues are worked and maintained, and this critical point would seem to be after about one-half the vitality of the bead had been consumed. At this period the bead has become weakened by excessive working and perhaps has shown indications of cracking and otherwise deteriorating. If the beads are of normal size and the beading or boot-leg tool of proper dimensions, there is less likelihood of guttering the sheet, but where the beads are considerably less than normal there is the greater danger of damaging the flue sheet, thereby shortening its ultimate life. There are decided views concerning the wisdom of using the roller as against the prosser, either with or without the boss, and under certain conditions the position may be well taken, but the fact remains that as a result of a number of carefully concluded experiments it has not been definitely shown that in the end the roller is as detrimental and therefore expensive as has been claimed. It might be interesting to consider for a moment a question which naturally arises when referring to the sectional prosser with and without the boss. Probably 20 years ago it was the idea that the boss was essential and that as one of its functions it helped to stay the flue sheet together by perfecting the joint on the water side; but, if this was a necessity with boilers carrying 120 to 140 pounds pressure the theory falls flat when it is asserted, and even proven conclusively, that the prosser with the boss left off is being used extensively in boilers carrying 200 pounds pressure and upward.

Having some doubt as to the real value of the above theories your Committee has made several laboratory experiments with a view of ascertaining the holding power of different types of settings of flues, with and without beads, as well as with and without ferrules, rolled and prossered; also to determine practically the possibility of using unbeaded flues in locomotive service. Such tests have been carried along uniformly for the past 16 months on several 100 ton Consolidation freight locomotives carrying a working pressure of 200 pounds. The particular engines in question are equipped with 258-2¼" flues 18'-6" long. The flues were placed flush with the fire box side of the flue sheet making no attempt whatever to bead them. These experiments were simplified by making them on locomotives equipped with the so-called re-inforcing sheet. Nothing is claimed for the re-inforcing flue sheet in these particular experiments in the way of increasing the endurances of the bead, but by construction it permitted the flues to be so carried as to prevent any possibility of the flues pulling through the fire box flue sheet. In among these 258 flues, 24 flues were put with beads locating them irregularly throughout the lower central portion of the set. While it can be said that the reports show that all of the flues required a certain amount of attention, it is also true that the number of times the unbeaded flues were worked upon as compared with the beaded flues is as 1 to 2.3. Encouraged by these experiments, and being able to continue in service engines with the beads left off, other engines have been fitted up in like manner, and the outcome has been that the 24 beaded flues in the experiment above referred to gradually broke down by deterioration, but not until they had given some six months service; on the other hand the unbeaded flues are still holding very satisfactorily and have been in service some 16 months. Upon close investigation it was found that the unbeaded flues were about normal. From the above we might conclude that the bead has no particular value towards preventing the flue from burning off; on the contrary, the beads have apparently picked up heat and possibly in proportion to the size of the gradually increasing stock in the bead aggravated by the thickness of the flue sheet, as well as any deposit of scale and mud and have burned off as might be expected. It might also be interesting to mention that while the unbeaded flues were flush with the flue sheet, they have, by reason of the rolling process, been drawn to possibly as much as 1-16″ beyond the fire side of the flue sheet.

Probably in many localities throughout the country the bead determines the life of the flue except where the water changes the conditions. It is generally known that working iron or steel, as the case may be, will harden and toughen the material destroying its ductility and hence under the present method of working the bead, however it is done, is from its initial application to its removal undergoing constant and severe punishment. The constant vibration of the flue undoubtedly sets up a movement in the flue sheet resulting in not only drawing the bead and otherwise distributing the original joint, but must also force the flüe inwardly and this theory is ventured because it is not uncommon to find the copper ferrules thinned out to twice their original length and driven inwardly. As this movement continues the bead is gradually drawn from the sheet increasing its exposure and decreasing its resistance to the impinging flames. In order to overcome this the bead must necessarily be subjected to constant working and rebeading. This work produces incipient cracks in the bead which occur as the material is gradually weakened by crystalization and we might reasonably infer that as the material is alternately opened and closed, a certain amount of impurities find their way into the bed, all of which has been pretty well determined, resulting in breaking them down and otherwise destroying them after obtaining remarkably low mileage. The bead in its present condition is certainly a victim of circumstances and mainly on account of the little protection it receives from the water. There is no disputing the fact that the circulation of water, however imperfect, affords some protection, but it is also true that a poor conduction of heat adds an incalcuable amount towards the deterioration of the flue bead together with the many disadvantages by reason of treatment and limitations in construction. (Applause.)

J. A. DOARNBERGER, Chairman,
JOHN GERMAN,
R. W. YOUNG,
D. B. LUCAS,
W. H. HEPP,
C. L. WILSON,
C. J. KLEIN,
Committee.

Mr. President and gentlemen, before taking my seat, I wish to mention that we are greatly indebted to Mr. A. Kearney, Assistant Superintendent of Motive Power of the Norfolk & Wesern Railway, for the kind assistance he gave in the preparation of this report. (Applause.)

The President: I believe a motion to adopt the report would be in order. What is the pleasure of the Convention?

Mr. Troy: I move that the report of the Committee be received with thanks.

The motion was seconded and carried.

Mr. Doarnberger: This shows a section of the front flue sheet, and this is the auxiliary, or what may be termed the reinforcing sheet. This flue sheet is but ⅜ of an inch thick. The flues are put in and rolled, making no attempt whatever to bend them. It cannot possibly get away. When the flues break down at the flue sheet joint, we have a long cutting-off tool and cut the flue off one-quarter inch back of the reinforcing sheet; the old end is then removed and a short new swedged flue is inserted into the flue left remaining in the reinforcing sheet. This is rolled with a long roller. It will be readily seen that we have put a new safe end on the flue without disturbing the main body of the flue or the smoke-box appurtenances.

Mr. German: Mr. Doarnberger, would you undertake to let an engine go out with a single tube sheet, with the tubes flush with the sheet on the fire side, with no stock or beads to protect the sheet, as you refer to on the 100 ton consolidated locomotive which has two sheets carrying a working pressure of 200 pounds to the square inch and the flues flush with the sheet? I should imagine from the report that, with the flues flush with the sheet, this boiler must have had extraordinary good water, or in my opinion you must have had more confidence that I have to allow a boiler to run with 200 pounds pressure with nothing to prevent breaking the joints of the flue sheet.

Mr. Doarnberger: We try and continue engines in service just as long as we possibly can in order to get the mileage. When you have one-third, one-half or even two-thirds of the beads gone, you continue to peg at those flues in order to keep them tight just as long as you possibly can. The average on our heavy freight engines is not over 45,000 miles, that is, on a single flue sheeted engine with the flues ordinarily rolled and beaded. On one style of engine we are not applying any beads on the firebox flue sheet. The first of these were placed in service some 18 months ago. They have made to date approximately 70,000 miles. They are still in a good serviceable condition.

Mr. Hemphill: There has been considerable controversy as to whether it would be permissible to permit an engine to go into service with no beads on. That all depends on the flue, and the factor of safety under your laws If you permit an engine to run under the percentage of safety, it would certainly not be proper to allow it to be in service; but if you have a new set of flues and can retain those flues the full thickness, there is no danger so far as I can see in Mr. Doarnberger's idea. What he has taken away from the flue sheet on the bead he has put in the reinforcing. So far as running that engine with that construction, it is certainly the same as if you had beads.

Mr. German: I didn't say anything about the construction at all.

Mr. Hemphill: I think Mr. Doarnberger has made some movement along the line of getting away from the old method of putting in flues, which is an improvement, and I believe some good will come from just such construction. It is not necessary to remove the flue, but simply remove the piece and take it out. I like the idea very much.

Mr. Doarnberger: What led us to the unbeaded flue was this. In 1906 the Norfolk & Western had built 125 engines. They were all equipped with this reinforced sheet. We confidently thought by bolting this sheet, as will be seen by the drawing, to the flue sheet, that it would act as a support and at the same time prevent the flue sheet from sagging or bulging. The flues were rolled in the reinforcing sheet as well as in the back flue sheet, thereby giving them a holding power of something over double the original method. This additional sheet released the flue joint as well as the flue sheet from carrying the whole load, and the vibration takes place from the reinforcing sheet forward. We generally get our foremen together about twice a year, and in talking over these particular engines it was unanimously agreed that after the beads burned and flues thinned they leaked less and gave better service. We then came to the conclusion that this being the case we would reduce the thickness of the flue sheet at from 5-8 inch to 3-8 inch and at the same time apply the flues without beads flush with the fire side of the flue sheet. The flues are holding up very satisfactorily and giving us little if any trouble. We consider this arrangement a great improvement over our former method of setting flues.

Mr. Lucas: We are all well aware that when our flues are in such condition that the bottom beads are all off we are not getting very good service generally. We know the condition when the beads come off and put in a plug or two. That is a temporary method of getting the engine over the road from week to week. We don't propose to let the plugged flue run a day longer than we can help. He is talking about cutting them off this side of the inside sheet. It is not very easily done. You have to take out that piece. Then he must get his piece to go inside and he must roll it sufficiently strong to protect the front flue sheet as well as the back flue sheet.

The President: Mr. Lucas, if I understand it, the idea is that the flue that is already in there holds the inner sheet in its place with a bolt into the other one. The piece is just to protect itself there.

Mr. Doarnberger: That is the idea exactly. The load is taken from the flue sheet proper and transferred through to the auxiliary sheet by the bolts which unite the two sheets. That short section has nothing to do with it at all.

Mr. Lucas: Why don't you put in short pieces from the start?

Mr. Doarnberger: It would be impracticable on the first application to apply the short section.

Mr. Lucas: You can take them out so readily.

Mr. Doarnberger: When conditions become such as to necessitate their renewal I take them out.

Mr. German: We have adopted a system on the Lake Shore and I might say the New York Central Lines, including the Big Four, the Michigan Central, Lake Erie & Western, etc., of applying flues. We drill the holes in the back flue sheet to 1 7-8 inches, use a No. 13 copper ferrel and swedge the flue, tapering back 4 inches, thereby giving a wider bridge or union between flues, leaving space for a better circulation of water at the fire box end. Two years ago this experiment was tried on the Lake Erie & Western, a road that we could only get about 10,000 flue mileage on account of accumulation of mud and sediment, caused by salty water. We equipped 17 engines on this road with these reduced flue ends and we increased the mileage to 40,000 A committee was appointed and worked on the subject of reduced flue ends for a year. The New York Central, Big Four and Michigan Central equipped a number of engines with reduced flue ends for trial and the results obtained were so good that they have adopted the reduced flue on the whole system. I can assure you, gentlemen, that we have boilers to-day on the Lake Shore, both passenger and freight, that have a mileage record of 100,000.

Mr. Doarnberger: What is done with flues that are beyond the inner sheet when they are clogged with mud?

Mr. Doarnberger: They are taken out.

Mr. Lucas: I wish to corroborate the statements of the gentleman who just spoke by passing these papers among the members, showing the mileage on 15 engines that were recently put out of our shops, in from 29 to 49 months service, all heavy power, 200 power pressure. We have used an arch a great many years We believe in the arch. Our mileage has run from 118,000 to 241,000.

Mr. Doarnberger: Mr. German asked me when a flue became muddy what I did with it and I told him I took it out. That is true. We have some engines on the road with deep narrow fire boxes carrying a working pressure at from 160 to 180 pounds. The flues in these engines give from four to six years' service, while the wide type fire box boilers carrying a working pressure of 200 pounds give but 13 months' service; yet these engines are working under the same water conditions, as I said, our flues are not beaded at the fire box end and the mud does not accumulate between the flue and reinforcing sheets. Therefore, I can keep right on putting on my short ends, or until such time as the mud will necessitate the removal of the main body of the flue, and this is where we save a considerable amount of money in flue renewals.

Mr. German: I go over five different roads. We have places where it is impossible to run an engine any longer than four months and other places where it is impossible to run them any longer than 12 months. To-day we are getting 2 years and 10 months out of them in the same places, and the water conditions are just exactly the same as they were then, but we are using brick. We are washing our boilers clean with the use of soda.

Mr. Letteri: One of the members spoke of reducing the flue at the fire box end. We had a place where our flues only ran three months, and by reducing the flue at the back end we gained a little in mileage, but reducing it did not prevent the mud from getting into the front end of the boiler. The life was a trifle longer in the back end, but they began leaking in the front end. In regard to the brick arch, I never saw one where you could keep mud out of the boiler. (Applause.)

Mr. Wilson: While we are on the flue proposition, I think there is one thing that is neglected more than anything else, and that is the boiler washing. I think it has as much to do with the life of the flues as anything in the world. We have about 225 engines and run from 115 to 125 a day. We had considerable trouble with flue failure, and one of the first points I took up was boiler washing. I don't believe the plugs had ever been removed since the engines came from the locomotive works. Some of the old boilers did not have half enough plugs. I have been putting from 12 to 15 extra washout plugs in those engines. Where we used to have a great number of engine failures on account of flues leaking, within the last six or eight weeks I had to answer for four engine failures. Three of them were due to bursted flues and one was due to an engine not steaming. But as far as an engine leaking or falling down on the road, I have not had to answer for a one for the last six or eight weeks.

The President: I have data and blue prints about patch bolts from the different roads all over the country. Everybody has a different kind of patch bolt. It is something we ought to go into and get a standard patch bolt. I had in mind to appoint a committee to look after this, but we did not have the time and perhaps we had better wait until next year.

Mr. Smythe: I move that the discussion on this subject be closed.

The motion was seconded by several members.

The President: The motion is that the discussion be closed. There is another report on flues.

Mr. Lucas: Is this Committee to be discharged or continued?

The President: There is nothing in the motion to that effect.

Mr. Smythe: I move that the Committee be honorably discharged with thanks.

Mr. Lucas: We have not discussed the best method of caring for flues on the road. We have only discussed the method of putting them in.

The President: The motion is to close the discussion.

Mr. Lucas: I am ready to close the debate but I would like to have the Committee carried over.

The President: They will appoint a committee again for next year. A committee has been appointed to report suitable subjects for the next Convention. They certainly will take up flues again.

The question was put and the motion carried unanimously.

The Secretary: We have letters expressing regret at inability to attend the Convention, and extending cordial greetings and best wishes for success and prosperity from the following members: Frederick F. Zeppe, L. N. Stewart, Charles E. Frick, Charles Miller.

The Secretary: Since the Convention opened, our worthy Vice-President, Mr. Brown, has presented a number of new applications. We have also those of James G. Green and F. N. Witte. The first of these is endorsed by William McLean and A. M. Poston, and the second by A. N. Lucas and P. J. Conrath.

Several members of the old Associations, who have not heretofore affiliated with us since the consolidation, have done so at this Convention. (Applause.)

Mr. Laughridge: I move we suspend the regular order of business and vote on the two applications.

The motion being seconded by several members, was put by the Chair and carried unanimously.

Mr. Hemphill: I move the applications be accepted.

The motion was seconded by several members, and on the question being put by the Chair was carried unanimously.

Mr. Laughridge: I move that the Secretary be instructed to properly acknowledge the regrets of absent members.

The President: That will be attended to.

On motion the Convention adjourned until 9.30 o'clock Friday morning.

FOURTH DAY'S SESSION.

The Convention met pursuant to adjournment at 9.30 a. m. and was called to order by the President.

The President: The first order of business this morning is the report from the Committee on Steel versus Iron Flues.

REPORT OF COMMITTEE ON STEEL VERSUS IRON FLUES.

Mr. O'Connor: I wish to make a few explanations before this report is read. You will note in the body of the report when read that my experience has been very limited with the steel flues, consequently I can say at this time but little concerning these two metals. On the Chicago & Northwestern lines west of the Missouri river we have had since May, 1908, several locomotives equipped with the steel and iron flues, half and half in each locomotive. Up to date we have not had occasion to remove any of them, either the iron or the steel, from our boilers. From reports received from time to time we cannot complain of the service given from either the iron or the steel flues, both giving, so far, good satisfaction. I have, however, made personal inspection of the flues in the fire box of a few of the engines, and by close observation relative to the flue bead at fire box end I found the steel flue bead to have a little advantage over the iron bead as the steel bead remains closer and firmer to the flue sheet surface than the iron bead. That is all the material difference I could note between the two metals.

By the time of our next Convention in 1910, I will, in all probability, have removed some of these experimental flues from the engines so equipped, and then I can make a more complete report, giving the accurate service and general condition of the two metals as found in our section of the western country. We must not forget that water conditions are not all the same in all parts of the country, and in that respect we must depend on what will be brought forth from a thorough test of actual service.

Therefore, I will say that in my short experience with these two metals, I would consider this report that will be read before you incomplete, and would suggest that this Association continue this Committee over another year. I would also suggest that the incoming president appoint two more members on this Committee, making the number five instead of three, and that the two additional committee men be among those that have had good experience with both the steel and iron flues.

The President: Mr. Sarver was on that Committee too.

Mr. Sarver: Let the Secretary read the report, please.

In submitting to you our report the undersigned Committee on the above subject would respectfully present the following:

Our personal experience and our investigations have furnished us such a wide difference in opinion, relative to the two metals mentioned in this subject, that it proved quite interesting as well as a hard problem for the Committee to determine anything like a satisfactory report; hence, it was so decided that presenting this paper to this Convention, giving our personal experience as well as those of other members thereby affording an opportunity for general discussion among all the members of the Convention with the object in view that by general discussion we, the Committee, would profit by the information obtained as well as all members.

We are also of the opinion that the introduction of the steel flue is not as widely known as the iron flues, consequently the ultimate possibilities are yet to reach a good many of us, who, as yet, have not had sufficient experience to determine which of the two metals have proven the most successful in a general way, in economy, as well as securing the best service.

The following report from Mr. B. F. Sarver of the Pennsylvania Lines, Fort Wayne, Ind., will be of interest to the members relative to steel flues. Mr. Sarver has this to say:

"Mr. Chairman—The locomotive at the present time is required to carry almost double the steam as it was a few years ago, and as a matter of safety, those in charge of the motive power department should advocate the use of the highest class of material obtainable having in view, at all times, economy and safety.

"In regard to seamless cold drawn flue tubes, I might say that the steel is made by the open hearth process and must be of the finest quality that can be purchased, otherwise it cannot be pierced. It is always uniform in quality and as you do away with the welding of the flues it makes a stronger tube than the ordinary iron tube. It expands and beads perfectly and in service the tubes hold their position in the flue sheet much better than the softer product. The steel tubes are truer in size and gauge than the welded ones, and are free from the objectionable scale caused by welding. And the surface defects can more readily be found.

"The surface of the steel flue is so densified that they are not so liable to be affected by pitting and corrosion, caused by the foreign substances in the water. They are very readily welded and can be installed in a boiler at a less expense than the iron tubes.

"Although the steel makers do not guarantee their steel to run below .04 per cent in sulphur and .03 per cent in phosphorus, I give you below the maximum and minimum carbons taken from 16 heats, made by steel makers for steel tubing:

Carbon	.10%	Carbon	.16%
Phosphorus	.008%	Phosphorus	.01%
Manganese	.39%	Manganese	.49%
Sulphur	.03%	Sulphur	.025%

"And in neither test the sulphur showed above .03 per cent and the phosphorus above .017 per cent.

"I might state that a great many of the large railroad systems of this country are using almost exclusively the seamless cold drawn tubes for safe ends. And as a great many of the roads have large quantities of charcoal iron tubes in service and in looking this matter up, I find they weld very readily into steel.

"It is generally understood that the end of the tube, especially the fire box end, has to stand the most severe punishment and if the railroads, generally speaking, have selected the seamless tube for the purpose of safe ends, they must recognize in it a quality superior to iron. I cannot see why, at a less expense than iron it would not be the most economical body tube for locomotives.

"The physical quality of seamless cold drawn steel tubes is as follows:

Tensile strength lbs. per sq. in.	50,000 to 60,000
Elastic limit lbs. per sq. in.	30,000 to 35,000
Elongation in eight in.	20% to 25%

"I might further say that after extensive tests made by the Steam Engineering Department of the United States Navy, they recommended some years ago seamless cold drawn steel tubing for the boilers of their battleships. This is also a fact with all the Great Navies of the World, their steam boilers are all fitted with seamless cold drawn steel tubing.

"I believe the time is not far distant when the Superintendent of Motive Power as well as the Boiler Maker Foremen will all specify seamless colddrawn steel tubing for all purposes.

"One of the lines with which I am connected uses steel tubing for safe ends exclusively. Since the adoption of steel at this particular place they have increased their flue mileage at least 24 per cent. The maintaining and caulking of flues in engine house has also been reduced the same proportion, 25 per cent. I have experienced no difficulty, whatever, in welding the steel safe ends to iron flues.

"Below you will find a chart showing five passenger as well as five freight engines with the mileage made with iron flues, as well as steel safe ends, we applied.

	Mileage made, Iron Flues.	Mileage made, Steel Flues,	Steel over Iron.
1 Pass.	60,299	108,478	48,179
1 "	96,273	103,330	7,059
1 "	41,684	115.723	74.039
1 "	50,128	87,524	37.396
1 "	84.561	120.088	35.527
1 Frt.	33,260	55,063	21,803
1 "	39,390	76,788	37,398
1 "	46.371	54.639	8,268
1 "	30,614	59.967	29.353
1 "	28,130	50 014	21,884

"I will conclude by saying that my experience in this particular line with what I have been able to find in looking this matter up and also with the increased flue mileage shown in the above chart, I cannot help but say that we are coming to the use of steel flues very rapidly."

Mr. Clement Ryan of the Union Pacific Ry., Omaha, Neb., also presents the following report:

"Mr. Chairman—I hereby beg to submit the following on the above subject and hope that it will at least open up a line of discussion that will be of benefit to all concerned.

"Regarding the use and value of steel as in comparison with iron flues, beg to say that in my opinion iron is the best for all purposes, especially as regards pitting. We have had a great deal of experience on the Union Pacific with both iron and steel tubes and find the steel so badly pitted after a service of from eight to twelve months as to necessitate 75 per cent of the flues to be scrapped, while iron flues running over the same district and under same water conditions last for years. I would, therefore, respectfully recommend the use of iron flues with steel safe ends as the steel safe ends in fire boxes stand the heat better than iron. It is standard on the Union Pacific to use iron flues with steel safe ends for fire box and the results have been good

"The welding of steel and iron flues requires a good deal of attention as the heating of these two metals is not the same and we have had a good deal of trouble in the past welding steel safe ends to iron flues. We would find after the weld was made that at a point about ½ inch from the weld the steel would be cracked, sometimes half way around the flue. To overcome this difficulty will say that after the steel pieces have been fitted to the flues and put in the fire it should never be removed until it is ready to weld, because immediately it comes in contact with the air and is then replaced in the fire, a certain per cent of the welding power is destroyed."

Respectfully submitted,
M. O'CONNOR, Chairman,
B. F. SARVER,
CLEMENT RYAN.

The President: You have heard the report of the Committee and also the recommendation of the Chairman. What do you wish to do with the report?

Mr. Lucas: I move that the subject of this report be continued for another year. The proposition is a new one, and a good one, and one we will always have before us. I believe we ought to go into it thoroughly and I suggest that the Committee be increased by the addition of two members.

The motion was seconded.

The President: The motion before the house is that the report from the Committee on Steel versus Iron Flues be accepted with thanks to the Committee and the Committe be continued one year with the addition of two members, making it five. Did the members wish me to appoint the other two?

Mr. Smythe: Two of the members of this Committee expressed themselves in the report and neither one of them agreed. Do I understand that we accept the report and agree that they are both right?

The President: No, we cannot do that. We are accepting their report as presented. They have given us the best information and conclusion they could. If the Committee is continued they will still be gathering information. We are not satisfied with what we have so far, but it is the best they could furnish us for the time and experience they have had. So we continue the Committee with the addition of two more members to make still deeper investigation and report at the next Convention.

Mr. Smythe: No doubt the charcoal iron tube people are perfectly satisfied to give the steel flue another year's trial and let it speak for itself; but I, for one, would dislike to take any part in deciding which one is the best. I think we came here for other purposes than to advertise any one make of an article or material; so I don't think that the charcoal iron people are a bit worried about being given another year's trial.

Mr. Goodwin: I would think that the motion should read "received" instead of "accepted," and that would clear it up There is no final report and the Committee is to be continued so that the subject is still open. In reference to the appointment of the Committee, it would be well enough for the new President to appoint the two new members. I believe our Chairman would be glad to have the new President receive all the honors that belong to his office.

Mr. Sarver: I do not think it is the duty of any committee to recommend whether steel or iron should be used. It is not the sense of my report at all. When you appoint a committee on a subject and ask that committee whether steel or iron is best, they must certainly say one thing or the other. What is left for a committee to do if they do not do that? It is nothing to me who furnishes the steel, whether it be Mr. Smythe or Mr. Goodwin. My report does not specify that we shall use the steel those men make, or any other makers of steel. The topic to my mind was this: whether this Committee thought steel or iron flues were best, and I gave you just exactly what my experience has been. From my experience, from the figures, and from the mileage and the service that we have obtained from steel safe ends, it would be impossible for me to come here and advocate iron; and if I am not allowed to give in my report the conditions that exist, you might as well not have a committee. I cannot come here and say iron flues are what I want when those of steel have run from 29 to 35 per cent more than iron in actual service. I only put in the paper what I know to be actual facts. Another thing has come up since I wrote that report. We had an engine that ran 40,000 miles with iron flues. We took it into the shop and applied steel safe ends. It has run 72,000 miles and is running yet. So you see that I cannot come here and say that iron flues are good as steel. (Applause.)

Mr Lucas: I believe what the gentleman has just said is just exactly what we want to know. The Committee has certainly made a good report. They have given us all the information they can. They have not specified anybody's make, but they should specify whether it was steel or iron. I don't think the Committee has anything to feel sorry about in this respect at all.

Mr. Brown: It is my opinion that when these questions arise before the body for recommendation we ought not to lose sight of conservatism. In my yard conditions are not the same as in your yard. There are members who can take either kind of flues and give good reports as to their use in their jurisdiction. I don't see how this assembly can adopt or recommend what material we shall use. The railroad company which I represent covers a vast area of country. We have good water and bad water districts. You have heard the good results reported by Mr. Sarver of the service steel flues have rendered his company. I presume we have members here who could give us a report of the good service iron flues have given.

Mr. Hemphill: I rise to a point of order. Is there a motion before the house?

The Chairman: I believe there is. I put the motion and then asked whether the Convention was ready for the question. We are open for discussion as long as anybody wants to talk. Mr. Brown, continue.

Mr. Brown: I don't believe that I am out of order. All questions are debatable before being put to a vote. That is parliamentary rule. I want to cite you conditions on the Louisville & Nashville Railroad. I don't see how we could conscientiously recommend the adoption of any material. It is only recently that I had to throw out flues weighing 22 pounds to the fool—that were practically new. There ought to be a long life in store for those flues, but the defect was on account of the action of the water upon them. It caused pitting. We have iron tubes in those same districts and you would not know there was any trouble with them. You can cite me as using both iron and steel. We are building 12 high pressure boilers and a test is being made with steel versus iron. A year from now I will have information as to the results. I want to remind you that it would be impertinent for this Convention to recommend any material that would not be good in certain localities.

The President: I believe there might perhaps be a tendency, and some members be somewhat inclined to believe that your Chairman has perhaps been influenced in this matter. I am not of that sort of make-up. I am perhaps rather sensitive. When I appointed this Committee, I did so fully and solely for the interest of this organization. When elected President of this organization no subjects were put before me. I selected them. The members of this Committee made just as able a report as they could. What are these meetings for if not for information? I have spent hours and hours in the evening, after my work, and out on the road, to select these committees. I have been turned down time and time again by members who were asked to serve on committees and had to take others. I was not connected with the concern that I now represent when I appointed this Committee and had no thought of going with any company of its kind. Some of our members talk as if I appointed this Committee just to bring out this subject in order to make recommendations for the adoption of certain material. That is not the principle of this Association. We have no line of material to recommend. We are here to discuss whether the material has given satisfaction or not, and if there is anything in the line of an evil to eliminate it and determine the remedy to be applied. It is our duty to look into it. When this Committee was appointed, I was general foreman boiler maker of the Missouri Pacific Railway. I found in certain places in the country that steel would not give the same satisfaction as iron; and that steel would give satisfaction in certain parts of the country where iron would not. What I wanted to do was to bring out before this Association what steel and iron had been doing. (Applause).

Mr. Goodwin: I can fully realize the embarrassing position of our president, and I want the floor just long enough to express my opinion about these facts. I don't believe we have in this Association a more conscientious or a man more devoted to the interests of this Association than our President, Mr. Conrath. (Applause). I have known him for years and years, and always found him to be straightforward. I know that Mr. Conrath had no idea or intention of appointing any one on this Committee to give his opinion in reference to one side of the question. I don't believe that the members of this Association think Mr. Conrath would do such a thing. He is naturally a little sensitive because today he is associated with the National Tube people. I do hope and trust that Mr. Conrath will not think that there is a member in this Convention who would consider for a moment that he had any selfish personal interest to serve in making these appointments or that he sought to give advantage to one or the other side. His only object was to bring out the true facts and the true conditions and the honest opinions of the members of this Committee. I spoke a moment ago of the appointment of the other Committee. I did that simply because I was fully aware of the fact that possibly it might be embarassing on the part of the President to appoint the other two committeemen, as he might think there would be some criticism or reflection with reference to it. I believe it would be more appropriate for the incoming President to fill this Committee. I hope Mr. Conrath will not assume that there is a member in this hall who feels that he would do anything wrong whatever in making appointments. (Applause).

The President: That is just why I asked the question from the member who made the motion, because it was putting me in an embarrassing position. I asked him whether he wished me to appoint the Committee. I thank you. That is all right.

Mr. Troy: I believe we ought to have all the information we can get on this subject. Many members have not said anything at all and I am sure many are using both steel and iron tubes. Is the subject open for debate now?

The President: The subject is still open for debate.

Mr. Troy: I have had a little experience with steel tubes, and I presume that in some places they will run, but not in my district. I have not a written report, but I can give you a verbal statement. I applied a set of steel tubes in an Atlantic engine carrying 200 pounds steam pressure. After it had run 30,000 miles I removed the tube and I had to throw 50 of the bottom tubes into the scrap, they were so badly pitted.

Mr. Gray: I do not know of a more live subject at the present time among railroad men than steel versus iron tubes. It is a pretty serious proposition for a man to change from one kind of tubes to the other, especially if he changes the body flues, because if he gets started on one kind of flues and finds they are not suitable for his district, he has to throw away several thousand dollars worth. I would like to hear from members in different water districts as to what their experience has been. We have a number of steel body tubes and a great many safe ends, and as far as the leaking and the life of the tube in the fire box are concerned, I have not been able to find practically any difference in my district.

Mr. Walker: Was it not the motion that the report of the Committee be accepted and the Committee be extended for one year with two members added to it?

The President: That is right.

Mr. Walker: That motion ought to be put before the house and carried and then a motion that the subject be open for discussion would be in order.

The President: The motion before the house is that the report be received and the subject be open for discussion. The rest of the motion was explained before—that the Committee be extended for one year with two additional members.

The question was put and the motion carried unanimously.

Mr. Lucas: Seamless steel tubes are rather new to us all. I presume there are few members who have not a set of steel flues in service undergoing test. Some are getting first class results where others are having trouble. We put in our first set of seamless tubes in January, 1905. We removed them after 45 months service, 168,000 miles. There was no pitting. Every tube went back into the boiler. We have about eight or 10 sets in service still doing business and have not found any of them pitted. We have iron tubes that are pitted badly on one of our divisions, scrapping 2,400 in six months, where we only scrapped 542 during the same period, on account of light weight.

Mr. Reddy: Is there anybody in the Convention who has had any experience with steel tubes in connection with treated water. We have no steel tubes on our road, but have contemplated putting in two sets for test purposes. We have treated water on our system.

Mr. Brown: I believe I am the member's honey-suckle. (Laughter). We weld iron ends on steel tubes and steel tubes on iron ends, and we have trouble in making these welds. But going back to the water conditions on the Louisville & Nashville. It is, as Mr. Lucas states. We all have a story to tell. I still say we ought to be conservative. Speaking of mileage, I have iron tubes that have made 130,000 miles between change of tubes.

Mr. Filcer: We find pitting on the tubes on several divisions of the C., C., C. & St. L., both in steel and iron tubes. This is owing to the conditions of the water. We have not discovered any pittings on divisions where we have water treating plants. We are getting better results from steel tubes that we did from the iron tubes.

Mr. Sarver: Mr. President, in making up my part of this report, I never took into consideration who was going to furnish these tubes. Nobody asked me that. I wrote my report simply on the conditions that exist. I would like to hear from Mr. Letteri, who has had more experience with steel safe ends on the Pennsylvania than anybody I know of.

The President: Mr. Sarver, we believe your report is very conscientious. It is a poor man who would not express his opinion and his experience.

Mr. Letteri: I started in on the steel tubes I think in 1896. We made a three-year test of them. Regarding pitting, my experience does not go so very far. We have very hard lime water, and we all know ehat no pitting takes place in lime water. It only occurs in places where they have real pure water. As far as service is concerned, just as Mr. Sarver stated in his report, the end of the flue that is in the back sheet, when the flues are removed, is heavier at the time of removal than the iron flue would be in three months service, and the flues at the present time are not removed on account of being worn out, but simply to get the mud and scale out of the boiler.

Mr. Wanberg: I have had some experience in the last 20 or more years and I find that an engine in constant service is not as apt to pit the flues as one that is taken out of service and left out of service from time to time. As between iron and steel, I could not say which would pit the quicker. My attention was called to a condenser less than two years ago which I applied to a set of flues. We took out the flues and found that an iron flue put in less than nine months before was badly pitted and was scrapped. I knew the trouble was not in the water altogether because we had flues that had given us better service. I found the dynamo set so close to this condenser that it made electrical connection between the two, and that was the cause of the trouble. That was two years ago. I put in a set of the same tubes made by the National Tube Company and we have had no further trouble from them. The previous trouble was due to the electric current and not to the material of the tube. My attention was also called to the west end of the H. & E. where we put in one set of flues. In eight months service the entire set was scrapped on account of pitting. We knew it was not the water because we had iron flues that ran longer on that same division. They had run for years and not caused us any trouble from pitting. We investigated and found that a man was using blue vitriol in the water. It was not the flue but the vitriol this man used. The same thing may exist on your road. I do believe, however, that the pitting of flues is due a great deal to taking an engine out of service and leaving it out from time to time. More damage is done in one week out of service than a month in service.

Mr. McKeown: I would like to ask Mr. Sarver or Mr. Letteri whether they find any difference with scaling in iron flues or steel flues—do they find any difference in cleaning with a flue cleaner?

Mr. Sarver: No, sir.

Mr. McKeown: Mr. Letteri, how about it, do you find any difference?

Mr. Letteri: Practically the same, I could not tell any difference in the cleaning.

Mr. Cushing: I have been handling steel flues since about 1900, and I have also had iron flues mixed in with them. When I started on this subject of steel flues we were getting 22,000 and 23,000 miles out of a set of flues. We put a test set in and got 69,000 miles. I removed the tubes, had them cleaned and examined, and found no signs of pitting. I also had some iron flues and found no signs of pitting in them. But in the last two years, flues in service four or five or six years, show pitting on both the iron and steel. I don't attribute it to the material, but to laying the engine up for a month or six weeks at a time, also to the flues being taken out of the boiler and put outside and left in the weather. They rust, and that starts the pitting. I don't think it is the fault of the steel or iron, but of the handling.

Mr. Linderman: I have been handling steel flues about six years. On our passenger power with the iron flues, the best we could do was 55,000 to 65,000 miles. With steel we raised our mileage from 110,000 to 148,000 miles. We have no pitting. With regard to Mr. McKeown's question relative to the cleaning of tubes, we found that steel tubes cleaned a little easier than the iron.

Mr. Johnston: Some time ago I was connected with a small road in the northwest, now a part of the Northern Pacific, where the blacksmith foreman and boiler foreman were requested to order or specify the material desired in their line; as boiler foreman. I tried steel and iron flues; also welded steel safe ends on iron flues and vice versa. We had no trouble either on account of welding or the service received, the steel and iron flues giving practically the same mileage—from 40,000 to 50,000 miles; that is, from shopping to shopping. We gave the purchasng department to understand that whatever tubes they could buy to the best advantage to the company we would use. I am now connected with the Santa Fe, and in the past two years we have had considerable trouble from flues pitting, in several instances getting only eight months service when it was found necessary to scrap them.

Mr. President: Was that with iron or steel?

Mr. Johnston: Iron tubes; and I believe as Mr. Cushing does that considerable of this pitting is caused by having them out in the weather, causing them to rust considerable, to which in my opinion, the pitting, after setting, can be traced.

Mr. Smythe: I believe an explanation is due Mr. Sarver of my remarks about the Committee. I would suggest to the chairman that he write to the members that are using iron flues, and in his report also embody a report from the iron flues. I do know there are large roads that are taking out steel flues and adopting iron. For what purpose I do not know. I have not the experience of you gentlemen, but I think that next year the Commtitee should have a report from both sides. The two gentlemen who were on the Committee had experience with steel flues and there was nobody who knew anything about iron flues at all. Surely it ought to be possible to say something good about iron flues and we ought to hear from the gentlemen who have the information.

The President: Excuse me, but iron tubes are mentioned.

Mr. Andrew Green: I think everybody in the hall has had experience with iron tubes, and I think those who have not had any experience with steel stubes will get good results if they try them.

Mr. James E. Cooke: The Bessemer railroad which I represent is a comparatively small road, yet we haul the largest tonnage of any road in the United States. We have engines carrying 225 pounds and during the past eight or 10 years have used nothing but steel tubes. We weld No. 10 steel ends onto iron and steel tubes using oil or coke for fuel. We have little trouble with the flues breaking after they are put into the boiler, but we do experience some trouble with flues pitting. We find that iron tubes pit as readily as steel in bad water districts, therefore, cold drawn steel tubes are the best in the market for our service.

Mr. Kelly: We have men here that use both kinds. I suggest that each one act as a committee of one so we will know what we are talking about next year and be able to recommend something to our officials. I suggest that we each make a test. I would also suggest that the chairman of the Committee write to the manufacturers. I believe next year, or two years from now, we will know just exactly what we are talking about, and I recommend we ascertain just where these pitted flues come from and report the outcome of the test.

The President: It was my idea that we would discuss the matter here, the members to then go home and go into the matter deeper and find out where they are.

Mr. Kelly: I would like to have them put in half and half in the same engine, the right side iron and the left side steel.

Mr. Lowe: As a representative of the Canadian Pacific

Railroad, I will state that we are operaeing in the neighborhood of 1,500 locomotives. The Western Lines, which I represent, have about 740. I believe I should have something to say in connection with our tubes and the material used. We are using steel tubes except in those cases where we are having experiments with other brands. In the good water district, as regards renewal, we are governed by the time adopted for internal inspection of the boiler. In the same districts with the iron ends, we find no gain or loss in connection with either material. But when we come into bad water districts, it is not a question of the vitality of the bead or security to the tube sheet, but of having to remove them for scale. We had been using the steel tube for many years before I came to your Convention. I am not interested in one particular brand of tubes over another. Every brand that is supplied us for experiment will get a fair trial. We have practically found no gain or loss in bad water districts, and in good water territory any flue stays in long enough to come within the time limit of internal inspection of the boiler.

Mr. Lucas: In making this test when you get your people to buy a set of iron tubes, I would like the members to keep a record of the work done on each set, and the number of flues plugged when in the shop, and give us complete data of what has been done. It will be well to state whether it was a good grade of iron tube against the steel tube or a common body grade of iron against the steel tube. Let us show up everything.

Mr. O'Neill: I have had a great deal of experience with steel tubes and I find after making several tests that by putting in half sets of iron flues and a half set of steel, in certain districts where we applied these flues and the condition of the water was very bad we took the flues out in about 14 months. The steel flues were pitted so badly we could not put them back; the iron flues were not pitted at all that we could notice. Before this I had been ordering all steel flues. I am still ordering some for safety ends, and I find I get better service from the steel ends than I do from the iron ends, but the steel seems to pit. It don't seem to have any particular place either at the bottom or top of the flue. After noticing it very closely, and studying these little pits, I think there is some kind of sediment or sulphur making a soft place in the flue that causes it; the action of our water has a tendency to cut through. There will be a small pit, and the flue will be all right all around for 12 or 14 inches, and still this little pit eats right through it. In the iron flue we don't notice that at all. However, I find that the steel end does better in the sheet than the iron end, and for that reason we have adopted the iron body, welding the steel end on, and we get very good results.

Mr. Rapp: In regard to this proposed test, to be absolutely fair with both materials, I believe it would be better, instead of putting in one material on one side and the other material on the other side, to put in alternate rows. I conducted a test several years ago with Swedish iron and steel on two engines. One engine had both injectors on the right side and the other engine had one injector on the left side and one on the right. I found in the engine that had both injectors on the right side, the left side flues played out first, and on the engine that had the injectors on each side, the injector on the fireman's side was evidently used most and the right side played out sooner. I would recommend in this test to make alternate rows of iron and steel.

The President: They might get mixed up and not be able to find out which was which.

Mr. Rapp: The only way would be to make a chart of the sheet, and represent one material by an X.

Mr. Elkins: I tried that scheme a few years ago. I put in a set of flues using iron and steel in alternate rows, but did not get any satisfaction from the experiment, for when they leaked we could not tell which had started the trouble as all of the bottom ones would be leaking; when we removed the flues after 11 months, the steel flues seemed to be pitted a little more than the iron ones. However, we safe ended the entire set.

Mr. Brown: The flues that we applied were never touched by the weather. Our flues are kept under cover. In our mineral districts, where steel will not live and iron will, the 12 boilers we are making I think will afford a fine test. There will be six Pacific types and six heavy freight engines, both high pressure. The flues on one side will be iron and on the other steel. For the benefit of this Committee I promise that I will give this my undivided attention for the next 12 months. If a report from me on this subject will be acceptable I will be only too pleased to give it to them, at whatever time they wish.

Mr. Lucas: There is one point I want to bring before the Conventon relative to welding steel safe ends on to iron tubes. I want to know what they are going to put them up against. If you use a good iron tube against a steel tube it will be a more fair test than if you use common ordinary body grade iron against the steel tube.

Mr. J. B. Smith: We have been using steel tubes for the last eight years. Previously we had been using charcoal iron. We started in to buy safe ends the same as tubing and we got two or three more months service out of the iron. Last fall we had a great deal of trouble in our vicinity with bad water and the tubes pitting and our mechanical department investigated to see what was the matter. I thought the steel flues were giving us the trouble, but we made a chemical analysis and it turned out to be the iron. We are now making several tests with Swedish iron flues versus steel, also sterilized iron flues and sterilized cold drawn seamless tubes. So I don't know what the result will be. I suppose by the time of the next convention I can make a report. We are making a test now, putting one-half iron on one side and steel on the other, but every other flue is steel and iron and steel iron and so on.

Mr. Brown: The Master Mechanics' Convention some years ago adopted specifications as to the best method in their judgment of making a test. This test we have accepted and it has been our guide. The end we put on a flue has to pass the specification, whether it be steel or iron; if it is a safe end it passes the specification and if it is a body flue likewise. This also specifies the gauge for the different parts, that is, the body and the safe end, and I think it is a complete test.

Mr. Linderman: I have been handling steel flues for nearly six years. On our passenger power with iron flues, the best we could do was 55,000 to 65,000 miles from a set of flues. After adopting a cold drawn steel flue, we raised our mileage on the same class engines to 100,000, with some engines running as high as 148,000 miles on one set of flues. We have no pitting. Referring to Mr. McKeown's question regarding the cleaning of tubes, we found that steel tubes cleaned easier than the iron.

Mr. McCarrahan: East of Pittsburgh and Erie we have about 3,200 engines. Up to the present time we have been using the best grade of charcoal iron. We have under construction at the present time in the Juniata shops 33 consolidation engines, having 465 two inch tubes 15 feet by 2½inches long. One-half of these engines are to be equipped with steel tubes and the other half with iron. One year from now I may be able to give you some data as to how they compare.

Mr. Elkins: I move that the discussion be closed.

Mr. Brown: I second the motion.

The President: It has been moved and seconded that the discussion be closed.

Mr. German: I have listened to the discussion on the pitting of flues. I have not heard any remedy advanced for the prevention of pitting. We use both steel and iron flues on the Lake Shore system. We have points on our system where the flues pitted very badly, but we have overcome that difficulty by the use of soda ash and the frequent washing out of boilers.

The President: I want each and every one to take an interest in this matter during the year, and write to the Committee on this subject so as to give them a chance to make good report at our next annual convention.

The question was put and the motion carried unanimously.

The President: We have with us Mr. C. H. Rae, General Master Mechanic of the Louisville & Nashville. I take great pleasure in introducing Mr. Rae. (Applause.)

Mr. Rae: Mr. President and gentlemen, it has afforded me great pleasure to attend your meeting, both from an educational standpoint and socially, and this is largely due to the manner in which you, Mr. President, have handled the matters placed before the Association, and the manner in which the members have co-operated with you in a full and free discussion of the various subjects. The boiler question is one of great importance and has been given much thought on the road with which I am connected. It has been the subject of great discussion, and I feel satisfied that my presence at your meetings will enable me to go farther into the matter than I have been able to do in the past. I have not only attained knowledge in your open meetings, but have gathered a vast amount of benefit from conversations with the various members of the Association.

I have been impressed with the fact that these meetings are not only beneficial to yourselves as individuals, but also to the companies with which you are connected, and I trust that you will receive the support that is necessary to bring you to the goal you seek to reach.

I hope that your visit to our city has been one of pleasure and great benefit, and wish you a safe return to those you have left at home. Gentlemen, I thank you.

REPORT OF COMMITTEE ON BEST METHOD OF APPLYING BRICK ARCH.

The President: The report of Committee on Best Method of Applying Brick Arch—Mr. O'Connor, Mr. German and Mr. Sarver. Mr. German, do you know anything about it?

Mr. German: No, but I want to have something to say about it.

The President: Then the Secretary will read the report.

Your Committee appointed to report on the best method of applying arch brick would respectfully submit, that after making a number of investigations of other roads, find that they apply arch brick in various forms, some roads using the plain stud screwed into side sheet to support arch, others using the angle steel fastened to side sheet, and a great many roads have adopted the use of the circulating tube or more commonly called, the arch tube.

On the Chicago & Northwestern Railway, all arch brick are mounted on arch tubes. We find it more convenient to apply arch brick on circulating tubes on account of the very short time it takes to apply; also the uniformity of the arch and the simple manner in which the arch can be removed and replaced in locomotives having boiler work to be done on arrival at terminals. A number of railroads object to the circulating tube on account, as they claim, failures in tubes cracking and the probability of tube blowng out, causing delay and possible danger to the engine crews.

In our opinion arch tubes properly applied and properly taken care of are not any more dangerous than any other tube in firebox. However, this is simply a matter of custom among other ralroads in applying arch bricks. So the adoption of any one method relative to this would probably meet with much opposition, consequently the subject was left without further notice by your Committee, leaving the subject for general discussion by members of the Convention.

M. O'CONNOR,
Chairman Committee.

Mr. Wanberg: I move that the report of the Committee be received and the subject be open for discussion. Carried.

Mr. German: The brick arch as well as other appliances put into fire boxes must be cared for when it is properly applied, and when cared for it is no detriment and will afford protection to the flues. A year ago brick arches were applied to all engines equipped with arch tubes on the L. S. & M. S. R. R. These arches have been maintained up to the present time. The method of applying the new design of arch brick was adopted January, 1908, and has given good results. The bricks do not fracture or fall out of place as frequently as they did, and brick arches are lasting in many instances for 90 days. Since the arches were applied the saving of fuel has increased from eight to 12 per cent and the boiler work on flues has decreased 75 per cent. The arch tubes are kept clean by means of a turbine cleaner known as the "Cyclone." The present style of arch as used is made close fitting to tube sheet and sides of fire box, no space being allowed between bricks and tube sheet. Each brick is moulded and fitted upon and between each of the arch tubes. This style of moulded brick is easily removed from arch pipes and can be replaced and repaired at a small cost. The bricks in this arch are not made in the long lengths formerly used, and being in small pieces they are easily handled, fitted, and removed. The cost of maintenance of brick arches has been reduced 55 per cent by adopting the present style of arch.

Mr. Letteri: When you adopted those arches, was it in a bad water or good water district?

Mr. German: It is now possible to use the arch tubes and arches in bad water districts. The tubes can be cleaned by the use of turbine cleaner and the arch bricks are so arranged that they will remain in position and cannot fall in. This style of arch forms a combustion chamber in the locomotive fire box, and as it prevents the heavy fire from coming in direct contact with the flues, will lessen the percentage of flue leakage.

Mr. Borneman: How far are the bricks apart after being placed?

Mr. German: Each piece of brick is 10 inches wide. We have various lengths, some run 12 and some 13. Some are as long as 23 inches.

Mr. Borneman: After they are in service a certain length of time, don't they have tendency to run together?

Mr. German: No, sir, the bricks will not run together. A glossy substance forms underneath the arch, and by putting a chisel in the top you can break that like a piece of glass. We have no trouble in removing them.

Mr. Borneman: We used a hollow brick arch and after they were in service four or five days or a week the brick all run together. In fact, they run down like ice would, and in removing brick you would have to remove them all.

Mr. German: Are they placed in like this?

Mr. Borneman: We just place them so that they meet in the center close to the side sheet at each side.

Mr. Elkins: I move that the discussion be closed.

The motion was seconded by several members.

Mr. Johnston: On our road that condition is true on coal burners only, and where oil fuel is used the flues leak all over, due to excessive amount of fire brick. Whenever they are cooled down to wash, it is necessary to work every flue, 391 in number, and we get those distorted and cracked flue sheets. We get the heat in the back portion of the fire box so intense that it burns the flanges of our sloping door sheets into a crisp. The heat in our oil burning engines is impinged on the back portion of fire box, fully two-thirds of the work being done at that point and we don't find that condition existing on our door sheets.

The President: The motion before the house is that the discussion be closed.

Mr. German: It is a well known fact that the fire coming in direct contact with the bottom flues causes the bottom flues to leak. If you put a brick arch in a fire box, put it in as a combustion chamber, to stop the fire from coming in direct contact with the flues, and then you will stop 50 per cent of your leakage, especially if you individually get hold of your engineers and firemen and tell them to use their feed water as they ought to.

Mr. Johnston: I don't believe that the air or fire striking the bottom flues has anything to do with their leakage, as in my opinion it is all in the handling of the feed water.

The President: The motion before the house is that the discussion be closed.

Mr. Smythe: I want to make a motion which I believe is for the good of the Association. Don't you think it would be wise for us to stop the remainder of the discussion. It is now 12 o'clock and we have all the regular business of our Association to attend to. I move we discontinue all discussion and go ahead with the last part of the program.

Mr. Lucas: I have been busy for the benefit of the Association during the discussion of the last paper, and I did not get perhaps what I ought to have. Am I to understand that the discussion on brick arches is closed and the committee discharged without any recommendation? I would like to see this committee held over.

The President: I appointed a committee at the opening of the Convention to select suitable subjects for next year, and they undoubtedly will take up this matter and continue it.

Mr. Lucas: I would like it to be carried over.

Mr. Wagstaff: As a member of the committee just mentioned, the subjects that are now on the program will be left to the discretion of the chairman. We have not taken up this question. Unless this meeting carries the subject over it is to be dropped. My suggestion is that it be left open and continued or made a new one.

The President: The motion is that the discussion be closed and the work of the committee extended for another year. This will leave it to my successor to appoint a new committee. The one that has been serving will be dismissed, but the subject is to be carried over for another year.

The motion was seconded by several members, and being put to a vote was carried unanimously.

The President: The next order of business will be the report of the Committee on "Flexible Staybolts, Compared with Rigid Bolts. Best Method of Applying and Testing Same." The Secretary will read it.

REPORT OF COMMITTEE ON FLEXIBLE VERSUS RIGID STAYBOLTS.

Before taking this question up in its component parts we have to consider the cost of applying these bolts in comparison with the cost of applying rigid or solid staybolts. I find in computing the cost of both the flexible staybolts and rigid staybolts, a difference of something like 50 per cent, which cost has to be credited to the applying of the flexible staybolts. The question now before us for consideration is, is the cost commensurate with the service and excess cost of this bolt over the rigid or solid staybolt? I maintain it is. Assuming we have an engine going through shop for general repairs, we put our staybolt inspector into ths engne, ordering him to thoroughly sound and test up here staybolts (rigid bolts). What is the usual result? From 50 to 150 broken or fractured staybolts. (All right). The necessary repairs are made and this engine goes out of shop in due time into service. Now let us follow up this engine, say for 18 months. What is out next observation? Well, here it is 3 months' service; we find on general inspection and hammer test of staybolts in this engine that we have anywhere from three to 50 broken staybolts to remove from this locomotive to place her in proper condition for service again. If the breaking of this engine's staybolts would stop here it would be possible to think well of the solid staybolt; however, it does not end here. It is more than likely that before the next 30 days pass by we have to lay this engine in again for broken staybolts. In fact this has been my experience more or less on this railroad. Now we have before us what the rigid staybolts are as a whole as applied to locomotive boilers and we can readily see the enormous cost they attain for renewals. Not only this cost is to be considered but the loss to the company for the time this locomotive is out of service, the earning power of which is approximately figured at from $6 to $700 per day

Now let us consider the flexible staybolt at a cost of 50 per cent more for application to a locomotive boiler. A case in point here at this point was, we shipped one of our Mother Hubbard type of engines for overhauling. This engine's boiler was sent to the boiler shop for a new firebox, with instructions to make a full installation of flexible staybolts, that is, back head, throat sheet, and both side sheets up to the seams of wagon top. Note particularly here that this engine has been in service now for over two years and has not had one broken staybolt removed from her boiler up to date. This looks pretty good for the flexible staybolts, when you remember that this same type of engine only runs from 60 to 90 days when more or less of the solid staybolts have to be renewed.

When we figure the cost of maintenance of locomotive boilers in service and compare the general cost of the solid staybolt against the first cost of the flexible staybolt, we can readily see, from a cost standpoint, that the excess cost of the application of the flexible staybolts, everything considered, has the best of the rigid staybolts, and as an economical question should be well considered by those who have authority to order the application of of this type of staybolts to locomotive boilers.

In the application of flexible staybolts I would suggest always a full installation of these bolts as it is a fact which I have observed when these bolts are applied spasmodically, or in what is considered the breaking zones, the rigid bolts next to the flexible bolts later on break or fracture. For this reason I believe it would be wise to always make a full installation, keeping before us always the loss to the company of from $6 to $700 per day for every day this engine is out of service, and as a rule this will occur when the company is in need of all their power and every wheel they can turn to handle their business.

I wish to add here, from causes such as bad water, or possibly a poor sheet of firebox steel, that it was necessary to remove a firebox from one of our engines to which I applied a new firebox about two years and one-half ago; this engine had a full installation of flexible staybolts and the gentleman who removed this firebox advised me that he failed to find a broken flexible staybolt in this engine, not even a fractured bolt.

APPLYING FLEXIBLE BOLTS.

When the firebox is placed in the boiler, mud ring fitted, firebox sheet faired up, the first thing I do is to map out the zones for solid staybolts, then I have these holes tapped out and staybolts run in. Thus I secure the firebox sheets from the danger of pulling in from each successive flexible staybolt applied. It only requires a very little strain on each bolt put in to draw the side sheets of a firebox until in the center of the side sheet, you will, by using a straight edge, find your sheet drawn in from one-half to three-quarters of an inch and where you have your bolts cut to length, this becomes a serious feautre in the application of flexible staybolts. Having had this trouble myself I have instituted the above method to overcome his difficulty and I am pleased to say it works out very nicely. When all flexible stay bolts are in the several zones, I remove the solid bolts that I have put in to stay the firebox sheets, and drill, ream and tap out and stallation of flexible staybolts in this engine.
apply the balance of the flexible bolts, this completing the full in

METHOD OF TESTING FLEXIBLE STAYBOLTS.

I recommend a hammer test under air pressure when it is possible to get a pressure of air from 125 to 150 pounds. Where the bolt is broken, this, in a measure, separates the parts and the broken bolts are easily detected. However it will be somewhat more difficult to detect a fractured bolt, but where the Inspector is a careful, painstaking man, this will soon be overcome as he will, in connection with this method, learn to detect the difference in sound of the broken and fractured bolts.

The method of applying flexible staybolts used here is the universal method laid down by the Tate Staybolt people. After the firebox is in position we drill the outside holes to the proper size for reaming and tapping, preparatory to applying sleeves. Previous to the application of the sleeves, we use a brass plug with a seven-eighth or one inch hole drilled in the center of the plug, screwing this plug into each successive hole to tap out firebox sheet. Then apply sleeve and bolts, hammer over same, using either a pneumatic holder-on with special die for this purpose or a capable bar made exclusively for the holding on of flexible staybolts. In connection with same we have a piece of pipe four inches long, threaded on one end, which we screw onto the sleeve, thus overcoming any contingency of the holding-on bar spoiling the threads on the sleeves. When bolts are hammered over and finished, we apply the cap and the job is complete.

Considering the application of flexible staybolts as applied to locomotive boilers it appears to me that the ball head of this bolt is the strong commendable feature of the flexible bolt as the users of this bolt in general will observe that the firebox sheets of a locomotive boiler in service is not retarded in their expansion, as the expansive powers of the plates are so adjusted by the ball head of this belt that all strains are relieved on the firebox sheets. While a former writer on this subject claims that there is no movement in this bolt whatever over the solid or rigid staybolt, it is hard for me to understand how this gentleman draws his conclusions. True, where there is no full installation, it is possible to a certain extent that this would be the case. However, where a full installation is made, owing to the ball bearing tendency of this bolt in the sleeve, it is possible for the sheet to expand in all directions, thus relieving the plate of the strain that is more or less connected with the solid staybolt installation. Where possible I would suggest that these staybolts be used in crown and radial stays as well, which, in my opinion would relieve practically all strains upon it from the fact that in its expansive movements it will come and go without any material strain whatever, furthermore enhancing the life of the firebox when the plates are of the very best quality of firebox steel. C. J. MURRAY.

The President: You have heard the report of the Committee. What is your pleasure?

Mr. Laughridge: I move it be received and discussed. Carried.

Mr. Brown: I hold in my hand a copy of the Master Mechanics' proceedings on this subject in 1906, and it is quite a long argument. It gives a history from the birth of the flexible bolt up to the present time. I believe it would be good judgment for this Convention to consider this for adoption. These bolts are expensive and they should be put to the best uses. I believe it would be wise for us to approve these proceedings of 1906 of the Master Mechanics, and offer a motion to that effect.

Mr. Lucas: I second the motion.

The President: The motion is that we adopt the proceedings of the Master Mechanics' Convention relative to flexible staybolts for the year 1906.

Mr. Brown: I would say that in these proceedings every flexible bolt known to this profession is mentioned and the maker is not given.

Mr. Smythe: It seems to me we are going to vote on something we know nothing about. It is an able paper we have heard read. The thing for us to do is to adopt something ourselves, to say whether the flexible staybolt is a success or not. I think it well for some one to make a motion that we recommend the flexible staybolt or reject it.

The President: It would be a good idea to take up the proceedings of the Master Mechanics' Convention before the Committee. Let them go into this matter and look it over, and they may embody part of it in their report. If there is anything in there that is good we want it, but I believe it is a little out of place now to adopt that without having any report from a committee of our own organization. I believe, as Mr. Smythe believes, that that is not right.

Mr. Berry: I do not see how this organization can adopt that, because I don't think that 10 per cent of the members ever saw it. It would be a blindfolded affair for us to undertake to adopt something we know nothing about. Perhaps it is very good. We will take Mr. Brown's word for it, but I don't think it is well for us to adopt anything of which we have no knowledge.

The President: Permit me to suggest that we receive the report from the Committee with thanks and the subject be continued another year with the recommendation that the committee next year take up the Master Mechanics' proceedings of 1906, go into the matter and, if they find anything of interest, embody it in their report next year.

Mr. Lester: I make that as a motion.

Mr. Brown: I withdraw my motion.

Mr. Lucas: I withdraw my second.

Mr. Berry: I seocnd the motion.

The question was put by the Chair and the motion carried unanimously.

The President: Is the Committee on Senate Bill here?

Mr. Smythe: I move that that be carried over until next year.

Mr. McKeown: Second the motion.

Mr. Goodwin: It seems to me since you have a committee appointed and the Chairman is with us, he ought to have an opportunity to be heard, making such suggestions or recommendations as he thinks advisable.

REPORT OF THE COMMITTE ON STANDARDIZING BLUE PRINTS.

The President: There is a report ahead of the Senate Bill—that of the Committee on Standardizing of Blue Prints.

Mr. Laughridge: I regret very much that I have to confess that that Committee did not accomplish very much last year.

The President: Has anything been done?

Mr. Laughridge: We did not get enough done to report anything definite, but we report progress.

The President: You would rather have more time?

Mr. Goodwin: Excuse me for rising again, but that has been an "old horse" ever since 1902. That subject has been up every year. I wish to insist on the Committee making a report next year. The Executive Committee is going to insist on the Committee having it here. Mr. Laughridge has been on that Committee before and he understands it well. He has made great progress, but he hasn't made a report yet.

The President: Mr. Laughridge, the members of the next Convention want a different report than progress. A motion to continue committee for one year is in order.

Mr. Gray: It does not need any motion.

Mr. Smythe: There is no report.

The President: Yes, he reported progress. Do you wish to continue this subject another year and appont a new committee or the old one?

Mr. Lucas: I move that we continue the old Committee until next year.

The motion was seconded by several members.

Mr. Goodwin: Three members of the Executive Board will be dropped this year. They only run one year. Mr. Rogers is one of the members whose time expires at this Convention. In case he should be dropped from the Executive Board —I hope he will not—your motion would be valueless. I think it is well to leave that Committee open.

The President: It will be all right to continue the Committee, and if any of its members do not want to act, others can be appointed. It will be for the next year's president to take care of.

Mr. Goodwin: Mr. Laughridge is one of the "has beens" this year, but if we re-elect him all right; I hope he will be re-elected, because he is a valuable man.

The President: The motion is that this Committee be continued for another year.

The question was put and the motion carried unanimously.

THE SENATE BILL.

The President: Now comes the Senate Bill. Mr. Flavin, have you any report to make?

Mr. Flavin: I have not a copy of the bill, but for the benefit of the members, in view of the fact that there was but a minority of the Committee present, and in view of the general trend of the bill, I don't think that it is proper that the members of this Association handle this bill in any manner at all. We don't propose to have any lobbying committees or anything of that kind. We meet for advancing ourselves in the interest of our trade and learning from each other, and not to force inspection bills. I move that the Senate Bill be dropped.

The motion was seconded by several members. (Applause.)

The President: What I was after was to bring out whether the sentiment was for or against putting this organization on record as being against such a bill—is that the idea?

Mr. Flavin: I will make that motion more comprehensive —that we eliminate any further action on matters of this kind. I would have the motion read that this organization does not propose to take action in any matter of this kind at any time. (Applause.)

The motion was seconded by several members.

The President: It has been moved and seconded that this organization, the International Master Boiler Makers, put themselves on record as being opposed—

Mr. Flavin: No.

Mr. Lucas: I move that the Committee be given a vote of thanks and the bill be dropped.

The President: The motion before the house is that the report of the Committee on Senate Bill be received with thanks and the subject dropped.

The question was put, and the motion carried unanimously.

Mr. Laughridge: I move that we adjourn until 2 P. M.

Carried.

AFTERNOON SESSION.

At 2 P. M. the Convention was called to order by the President.

The President: One of our members has a paper on Welding of Side Sheet and Welding Cracks. I saw the process myself while at St. Paul not long ago, and I thought it was very good. If agreeable, I would like to have a suspension of the rules long enough to have this paper read. Mr. Courtney and Mr. Guiry are both here.

Mr. Laughridge: I move that the rules be suspended, and Mr. Courtney read the paper.

Mr. Troy: I second the motion.

The motion was carried.

The Secretary: While we are waiting for Mr. Courtney I wish to announce for the information, as well as for the pleasure of the members of the Association, that the new members proposed at this meeting now number 34, and the receipts are over $300. (Applause.)

WELDING OF SIDE SHEETS AND CRACKS.

On the Great Northern Railway our Superintendent of Motive Power, Mr. Emerson, is welding patches into side sheets of fireboxes of locomotives with the acetylene welding process. Mr. Emerson has been experimenting with this process for the last three years and has now perfected it so that side sheets can be welded in fireboxes without any trouble in a very short space of time, the results of which after the engine has been in service are very gratifying; in fact, on nearly all patches that have been welded there has been absolutely no sign of leaking.

You might be interested in the process of making this acetylene oxygen gas for welding purposes. We have two separate generators, one for oxygen and one for acetylene. The oxygen generator is a heavy cylinder into which a chemical ingredient is placed consisting of chloride of potash and dioxide of manganese; these being mixed in certain proportions are heated in a cylinder, the gas passing off into a purifier and from there into a receiver. The acetylene gas is made from an acetylene generator that Mr. Emerson got up and is stored in receivers.

The blow torch is a torch gotten up by Mr. Emerson which he experimented with for a long time in order to perfect an arrangement to get the best results, which he evidently now has. When using this torch fire boxes are cut out of engines at least 50 per cent faster than it would require to take out the rivets and sheets in the old-fashioned way. The fire boxes are cut with this acetylene oxygen process in any number of parts required. In welding in patches the defective part of sheet is first cut out with the blow torch, then the remaining side sheet is beveled at about 60 degrees angle and the patch to be welded in is also beveled at the same degree and nicely fitted so sheet will become flush with the other sheet. The edges of both sheets around patch before being beveled at 60 degrees leaves a "V" groove into which the metal flows for welding sheets. He found that it required sometime to get that part of the sheet heated to a proper heat in order to make a perfect weld and still not allow the heat to run too far on the outside of the weld. This is necessary on account of the expansion which would naturally follow if the sheets are heated too far on either side of the weld.

When Mr. Emerson first experimented with the acetylene welding process he found it very essentional to get the right kind of material to use for welding. He first used spring steel about 3-16 inches in diameter, but found that it was a little bit too hard for boiler work. He then experimented with Vanadium steel; this seemed at first to give very good results, but on testing it found that the steel after being heated to a welding heat was too hard. He then tried Swedish iron, which upon testing was found to give the best results, the Swedish iron being very fibrous and soft made it very pliable which was just what was wanted where expansion contraction as you know on side sheets is very large.

I have with me three of the first pieces which were welded up with the spring steel, Vanadium steel and Swedish iron. You will note that on the piece welded with Vanadium steel the break was outside of the weld, which goes to show the holding part of the weld. Also three pieces we made a bending test on which gave us the idea to use Swedish iron as before stated.

Mr. Emerson is to equip nearly all of the shops with acetylene oxygen process and intends to do a great deal of his patching of fire boxes with the acetylene oxygen process and also to cut out fire boxes, which you can readily see it one of the biggest savings. At our Dale Street shops we have a large plant with the acetylene oxygen pipe into the boiler shop from the generator plant. This process is not only used for fire box work, but is also used for welding broken castings, broken parts of machines, etc. Up to date we have welded patches in at least 25 to 30 engines, some of the patches averaging from 36 x 60 inches, some of the engines gave considerable trouble into the longitudinal seams of side sheet leaking. This seam was cut out about 9½ inches, the whole length of the firebox and another sheet welded in and there has been absolutely no trouble as to leaking. Wish to say previous to that we had considerable trouble with rivet seam-leaking and we did not seem to be able to keep it tight, so Mr. Emerson decided to weld in a long piece.

I have only given you a smattering idea of the method and if you gentlemen wish to go into further details, Mr. Emerson would be pleased to show you anything he possibly can in regard to it and also give any information you wish.

M. S. COURTNEY.

Mr. Courtney: All our engines have been running as high as 15 months and there is not a particle of leakage in any of the side sheets that were welded. If an engine comes in with a crack eight or ten inches long, we take a diamond point and run it down and in a few minutes it is welded. The longitudinal seams in the firebox we could not keep tight. We take a 9½ strip off of a new strip and weld in there, and there is no trouble. We have found it a perfect success after three years.

Mr. McKeown: What kind of water do you have?

Mr. Courtney: All kinds of water. We have engines on our divisions the limit of whose set of flues was six months. Our water is so bad in most of our districts that we have to wash our engines every trip, at each end of the terminal.

Mr. Bowman: How long since you first used this method?

Mr. Courtney: We have been working it three years.

Mr. Brown: Have you operated this machine?

Mr. Courtney: No, I have not operated it.

Mr. Brown: You use something like a diamond point?

Mr. Courtney: Run a diamond point down through the crack.

Mr. Brown: I understand you put the metal in the cavity?

Mr. Courtney: It comes in sticks about the size of a lead pencil, Swedish iron.

Mr. Brown: They hold it up like solder and drop it in there after heating the sheet with an acetylene burner. Mr. Guiry was the gentleman that got me interested in it. It is nothing more nor less than puddle metal you put in there.

Mr. Courtney: That's all.

Mr. Brown: Will this metal bend?

Mr. Courtney: Here is a piece. It is welded with Swedish iron.

Mr. Brown: This is your weld?

Mr. Courtney: That is the weld.

Mr. Brown: Mr. Courtney, I have seen this operated. A gentleman was at the L. & N. shops with it not long ago, and he was willing to let me suggest tests, but he refused to let me bend it. I said "I will bend it anyhow," and it broke before it went 10 degrees.

Mr. Courtney: We cut a round piece 18 inches in diameter and then we cut a piece out of that of eight inches, and we welded a piece in there then. We put 76,000 pounds pressure on it. In the place the plunger was on it nearly severed the sheet, but where the weld was, it was never feazed.

Mr. Brown: We took a section of firebox plate, 18 x 36, in which I ripped a slot, about three or four staybolts. When he welded it up and it cooled off it was cracked down to the metal. When contraction set in this puddled metal gave way.

Mr. Courtney: We have had them running 15 months on our heavy engines and it is just as good as it was the day it was put in. If any one of you gentlemen will come up, we will be glad to show you.

Mr. Johnston: In taking out this piece in the longitudinal sheet, how do you overcome the part back of the lap on the door sheet?

Mr. Courtney: These are side sheets.

Mr. Johnston: On the side sheet it laps back under the flange of the door sheet.

Mr. Courtney: We run it up the side.

Mr. Johnston: You don't go back in there?

Mr. Courtney: Keep away 10 inches from laps. Mr. Guiry did the work on it.

Mr. Brown: We gave the young man all the attention we possibly could and we got him nicely located. He claimed the bar he melted was too high in carbon, and he asked me if I could get him some material of the same quality as the break he was welding. We have a special steel for patches in our fireboxes, and I sheared off several little strips as wide and as thick as he wanted. He seemed highly elated and accepted it as good. As he applied it he claimed it was the nicest material he ever worked. On the place he had in front of him he made a very nice job, but when we undertook to bend it, it broke. That was a narrow strip and it cracked of its own accord in the contraction in the wide strip.

The President: It appealed to me as a nice thing to use in place of plugs. Take a crack two or three feet long and rip it down with a diamond point. By ripping it open 1-4 of an inch the metal will bind and it will weld solid.

Mr. German: We are using the acetylene process for welding before commencing to use it on flue sheets that we intended for service. We took an old and discarded flue sheet, that was cracked out from the top flue hole to the knuckle of the sheet and welded it. We then inserted a flue in the hole, expanded it with 1¾ inch expander, driving the pin up to the head. We then put in an 1⅞ inch expander going through the same process and then a 2 inch expander driving the pin up to the head. This process enlarged the hole 1¼ inches from its original size with no signs of a crack. We have 10 or 12 engines that have been welded in knuckle of flange on flue sheet. One engine in particular has a crack crosswise of the sheet 20 inches long and is on the road rendering good service. We have not tried it on the side sheets yet.

The President: If any of the members can go up to the Great Northern at any time, it will be to their interest. They will show you everything and tell you what they have done with it. It appealed to me as being the coming thing.

Mr. Rapp: It was my pleasure a few days ago to visit a demonstrating plant of a hydrogen-acetylene welding plant in St. Louis. It is practically the same process, under a different name, as that now being used at St. Paul. The applications to which this torch can be put are wonderful. I believe it will be a great money saver to any railroad installing it, even in shops doing only light repairs. Here is a small piece of carbon steel that was welded for me; you will also notice the sample shows a slight curverture and a mark or depression on one side; this was done by clamping the sample in a vice and bending it with a hammer, showing the weld to be as solid as any other part. After polishing the one end as you see, I examined it under a powerful glass, but could find no effect. As to the cutting of metals, especially boiler plate, those that have never seen this torch with the cutting attachment in operation, can hardly realize the rapidity of the work; it cuts ¼-inch plate at the rate of, I judge, 14 to 16 inches per minute. This firm also has a portable plant which they load on a dray and take to jobs that for any reason cannot be brought to the shop. The day I visited them they had this portable plant out, welding a defective spoke in a cast iron fly wheel, 18 feet in diameter.

Mr. Lucas: I had the pleasure of visiting the Great Northern shops, and saw patches that had been in service eight and nine months, large patches, where it was necessary to wipe the soot off the box to find their location. We will have a burner by the time I get home. We are going to try the oxygen-hydrogen burner.

Mr. Hemphill: Your Committee on subjects for next meeting will report a topic upon this process, and when our next convention is held we will have a better understanding of it.

Mr. Laughridge: While we are interested deeply in this subject, the time is slipping away pretty fast. I move that we accept Mr. Courtney's paper and extend the thanks of this Association to him for his information.

Mr. Letteri: I second it.

The question was put by the Chair, and the motion carried unanimously.

REPORT OF THE COMMITTEE ON AMENDMENTS TO THE CONSTITUTION.

The President: The next order of business will be the report of the Committee on Amendments to the Constitution and By-Laws.

Mr. Laughridge: We have not very much to report this time. I believe it would be advisable to change Article XII, Section 3.

"The initiation fee of $3.00 shall accompany each application for membership. Dues payable as per Section 2 of this Article."

Section 2 reads "The annual dues shall be two dollars ($2.00) per year, payable April 1st." The Committee recommends that Section 3 be null and voil, and an assessment be substituted, reading "The sum of $5 shall accompany each application for membership, the said sum to cover the initiation fee and dues for the fiscal year."

Our fiscal year begins the first day of April. New members come to this Convention, and according to this Constitution are required to pay $3, nothing said of the other $2 until next April. By amending this so it will read "The sum of $5 shall accompany each application for membership, the said sum to cover the initiation and dues for the fiscal year." We get the annual dues at once with the application. Under the old rule a member would have the advantage of being a member for 11 months without paying any dues.

The President: Have you any other recommendation?

Mr. Laughridge: That is all.

Mr. Goodwin: The Executive Board during the last session have taken authority to act on that because they thought it was only justice to the members of this Association that new members coming in during the year should pay dues. Furthermore, we needed the dues. The Board decided that $5 must accompany all applications. I think this Convention should sustain them in that."

Mr. Troy: I move the adoption of the report.

The motion was seconded by several members and carried.

REPORT OF THE COMMITTEE ON SUBJECTS.

The President: The next order of business will be the report of the Committee on Subjects. If any of the members have subjects in mind they can prepare them in writing and hand them in.

Officers and Members of the International Master Boiler Makers' Association:

Your Committee on Subjects respectfully recommend that Nos. 1, 3, 4, 5, 6, 8 and 10 upon the programme of this Convention be carried over to another year, with the additions of the following:

"What progress is being made in welding processes used on boilers?"

"To what extent do firedoor holes crack, and what is being done to prevent it."

"What radical departures are being made in boilers and fireboxes."

"The cause of flue holes elongating in firebox flue sheet, and a preventive for same."

"A standard patch bolt."

C. L. HEMPEL,
GEORGE WAGSTAFF,
THOMAS LEWIS,
THOMAS J. REDDY,
Committee.

REPORT OF THE AUDITING COMMITTEE.

The President: The next order of business will be the report of the Committee on Auditing.

Louisville, Ky., April 30, 1909.

Officers, and Members of the International Master Boiler Makers' Association:

The undersigned Committee, appointed to audit the books of the Secretary and the Treasurer, respectively submit the following report: We found the books of the Secretary and the

Treasurer correct, except as to one item in the report of the Secretary, which was a mistake in figuring, amounting to $4.76, which changes the amount due the Secretary from $53.67 to $58.43.

Respectfully submitted,

W. H. LAUGHRIDGE,
JOHN TROY,
G. C. WEHLING.

Mr. Goodwin: I move the report be received.

The motion was seconded by several members. Carried.

REPORT OF SUB-COMMITTEE ON STANDARDIZING OF TOOLS.

Mr. Lucas: Mr. President, have we had a report from the Committee on Standardizing Tools?

The President: No, not yet, but we will come to it.

The Secretary: The report is here. I was going to bring it up under Miscellaneous Business.

Louisville, Ky., April 30, 1909.

Officers and Members International Master Boiler Makers' Association:

The undersigned, to whom was referred the report of the Committee on Standardizing of Tools and Shop Equipment, respectfully recommend that the Committee be continued for another year, and that they consult with manufacturers for the purpose of arriving at a standard for punches, dies and coupling.

We also recommend a drift pin.

We also recommend that this Committee request manufacturers to get together and standardize the bushing or mouth piece on pneumatic hammers.

We have found the work of the Committee very commendable, and for which it deserves much credit.

J. T. KELLY,
A. N. LUCAS,
HENRY L. WRATTEN.

The President: You have heard the final report of the Committee on Standardizing of Shop Tools and Equipment. What is the pleasure of the meeting?

Mr. Patrick: I move the report be accepted, and the Committee discharged, and the report be turned over to the Committee which I believe will be continued for another year.

Mr. Troy: I second the motion.

Mr. Goodwin: Mr. Patrick is wrong about discharging the Committee.

Mr. Smythe: He speaks of this second Committee that was appointed.

The Secretary: Is this a continuation of the Committee signing this report or the old Committee?

The President: This Committee here.

The Secretary: Is this report to be included in the official proceedings of the Convention?

The President: Mr. Kelly, let us hear from you. Does this Committee wish to have the old Committee continued for one year?

Mr. Kelly: That was the understanding.

The President: That would hardly be possible. The Committee has been dismissed and we have selected a new Committee.

Mr. Kelly: We are not particular about that as long as another committee takes it up.

Mr. Wagstaff: I thought that was one of the standing Committees to serve annually.

The President: The motion before the house is that we accept the report of the Committee on Standardizing Shop Tools and Equipment, and the Committee be continued for one year.

The question was put by the Chair, and a vote being taken, the motion was carried unanimously.

Mr. Wanberg: I don't know whether I am out of order or not, but I feel that we ought to say a few words in behalf of the "Boiler Maker", a very able paper that is published for the benefit of boiler makers. I feel that every master boiler maker should take an interest in this paper.

The President: We all know that it is a very able journal, and each and every one of us should advertise it as much as possible wherever we go. I don't believe there is a better journal in this country.

Mr. Goodwin: It is the only one.

The Secretary: I have three applications for membership which have not been voted on.

Mr. Goodwin: I move they be initiated in due form.

The Secretary: Do you think we could do it here.

Mr. Goodwin: Yes, I believe so.

Mr. Wanberg: I move the applications be accepted. Carried.

REPORT FROM THE WOMEN'S AUXILIARY.

The Secretary: Mrs. Laughridge, the new Secretary of the Women's Auxiliary, has asked me to present at this session the following acknowledgement, and to say that last year they gave their written acknowledgement to a member of the Association and he lost it. (Laughter.) The Secretary will undertake not to lose this.

"We, the ladies of the Auxiliary to the I. M. B. M. A., desire to use this method to express our thanks to the Supply Men's Association for their many kindnesses and attention shown us during our stay in Louisville.

"This year we feel that words entirely fail us when we attempt to express our gratitude, owing to the fact that the crowning feature of our entertainment, the banquet, was a strictly dry affair.

"We also wish to express our high appreciation to the Ewald Iron Company for the dry boat which they furnished for our excursions. We wish to assure them that the complexions which we shall carry back to our several homes will continue to remind us of the beautiful river which is the pride of their city.

"Realizing the vast amount of money expended for our pleasure, and knowing that it is the desire of the Supply Men's Association that we visit all points of interest, in justice to the Association, we, in chorus, suggest that one or more members of the Association accompany us on our future trips, if their business interests are such that they can do so.

"Again thanking the Association for all the manifold kindnesses shown us, we wish to assure them that in the years that are to come we shall ever have in mind their interests.

"By order of the Committee:

"MRS. LAUGHRIDGE,
"MRS. LUCAS,
"MRS. COOPER."

The President: Is there any further miscellaneous business?

The Secretary: Nothing more.

The President: Any unfinished business?

The Secretary: Nothing.

REPORT OF THE COMMITTEE ON RESOLUTIONS.

The President: Next is the report of the Committee on Resolutions, Mr. John H. Smythe, Chairman.

To the Officers and Members of the International Master Boiler Makers' Association:

Your Committee on Resolutions beg leave to submit the following for your consideration with a recommendation for its adoption:

The International Master Boiler Makers' Association in convention assembled herewith, spreads upon its records this expression of its high appreciation of the happy manner in which the comfort, enjoyment and entertainment of its members and their families has been promoted during the Third Annual Convention of the Association in the charming and progressive city of Louisville, Ky.

A further pleasure is experienced in bearing testimony to the satisfaction afforded during our brief sojourn here that this metropolitan gateway to the South was selected for our Convention. It has afforded us an exceptional opportunity to personally know the proverbially broad, generous and delightful hospitality always so freely extended by Southern people to those who are so fortunate as to become their guests, and of which we had only an inkling. We now perfectly understand what it is that at all times and under all circumstances has given the South and its people an enviable and matchless reputation, fully justifying the great pride they take in their institutions, their manifold social attractions, and the spirit of enterprise and determination that has eliminated the ravages of disaster, placed misfortunes almost beyond recall, brought substantial growth and prosperity and insured to future generations the unlimited enjoyment of the material benefits of human existence.

These thoughts and sentiments were quickly prompted by the kindly welcome and greeting extended by His Honor, James F. Grinstead, Mayor, and the Hon. Frederick W. Keisker, president of the Commercial Club of Louisville; Mr. Theodore H. Curtiss, Superintendent of Machinery; Mr. C. H. Rae, General Master Machanic, and Mr. H. C. May, Master Mechanic of the Louisville & Nashville Railroad, and which have been emphasized by personal experience that will always serve to make our stay a pleasant memory. The best that we could possibly have expected has been more than realized, and we will return to our homes and daily avocations with but one deep regret—that we could not remain longer and further extend our knowledge of what the South is, and what it is doing; and of which Louisville, its people and its business activities and accomplishments are such a lively, profitable example. In this connection we find occasion to refer with pleasure to the Hotel Seelbach to commend its management and its excellent accommodations for convention purposes, and to thank its managers for having done so much to make our stay agreeable.

We are again deeply indebted to the members of the Supply Men's Association, individually and collectively, for the happy as well as successful manner in which they have provided creature comforts, and those social divertisements which are always a source of relief to mental and physical strain. Our convenience and enjoyments have evidently had their constant personal solicitude and as beneficiaries thereof we find occasion for gratulation and grateful acknowledgement. How thoroughly the importance of the position our Association occupies before the world is understood, and that our work is recognized of widespread value has been demonstrated in the liberal space and close attention accorded our proceedings by the daily newspapers of Louisville. We desire to thank them very heartily for this mark of their consideration, and with equal effect we would accord a need of praise and tribute to the technical press, especially the Boiler Maker and Railway Journal and its representatives for the liberal recognition we have always received from them.

A matter of pride and gratification is the stability of the Women's Auxiliary, and which through the attendance of its members is a source of perpetual sunshine, zest and happiness at our conventions. Woman is man's radiant and inspiring companion and counselor, and so long as he keeps her by his side he is assured of protection, guidance, and whatever measure of success he attains by honest, conscientious effort.

Finally our work would lack that graceful finish afforded in a rightful and just recognition of merit, and so we make special acknowledgement to the officers of the Association, who during the past year so carefully and efficiently conducted its affairs with due regard for its greatest welfare and best interest, and whose reward comes in the splendid success of this Convention that is the crowning feature of their able administration.

J. H. SMYTHE,
P. F. FLAVIN,
JNO. MC KEOWN.

Mr. Wagstaff: When I landed in Louisville on this trip, about the first gentleman who was in the lobby of the hotel to shake hands with me and give me welcome was the General Master Mechanic of the Louisville & Nashville Railroad, Mr. Rae. Shortly afterward I found Mr. Rae on the sidewalk hustling the members to where they could find the best hotel accommodations, and I don't think any man has worked harder to make us comfortable in this city than Mr. Rae. If it would be consistent, I would respectfully request that Mr. Rae's name appear in the resolutions with Mr. Curtiss and Mr. May.

Mr. Smythe: I think Mr. Rae's name is in the resolution.

The President: If it is not, it shall be.

Mr. Wagstaff: Pardon me, if I made a mistake. I would rather be out of order myself than have it overlooked.

The President: If it is not in, it is an oversight and our attention should be called to it.

The President: What do you wish to do with the report of the Committee on Resolutions?

Mr. Laughridge: I move a rising vote accepting the resolutions with thanks to the Committee for their efficient work.

Mr. Wheeling: I second the motion.

A rising vote was taken and the motion carried unanimously.

NEXT PLACE OF MEETING.

The President: The next order of business will be the selection of a suitable place for our next annual convention. Before this matter comes up I wish Mr. Slate would give us his ideas as to where and how the supply men would like to see us.

Mr. Slate: I don't know that I have any right to say anything as to where the location of your next convention shall be. There are a few things to be considered in regard to this matter, and one is attendance. I don't mean attendance of supply men, because they can go anywhere if they want to, but I mean your own attendance. The number of your own members who will attend your meeting. Personally I don't believe it wise for a convention like this to go to a big city, there are too many counter-attractions. Secondly, your convention, in my estimation, should be centrally located, and I believe any location from Buffalo to St. Louis is all right. I am not pulling for any particular place. I have not sounded the supply men. I have talked with a few of them, but I have no right to say that I voice their sentiments. Personally, however, I believe that Niagara Falls is the place to take the convention, or some city of that size, I am not pulling for Niagara Falls, but I mean some city without too many counter-attractions. As I said last night, this comvention is growing in importance and in size and you are bringing yourselves to the attention of your superior officers in a way that is gratifying, not only to yourselves and to them, but to outsiders. Pleasure is a good thing, but what you are after is the discussion that takes place in the convention, and I believe that these things should be taken into consideration along with selecting a place where you are likely to get the largest number of members present. (Applause).

The Secretary read the report of the Committee on suitable places for the next convention as follows:

Officers and Members International Master Boiler Makers' Association:

We, your Committee on location of next place of meeting,

We, your committee on location of next place of meeting, beg to submit the following cities for your consideration:

Denver, Col.; Omaha, Neb.; Washington, D. C., Niagara Falls, Buffalo, N. Y.

C. E. ELKINS,
J. J. MANSFIELD,
J. J. GREEN,
T. W. LOWE,
Committee.

The President: You have heard the places mentioned by the Committee for the next Convention. It would perhaps be advisable to ballot on these places.

Mr. Goodwin: I don't think we ought to hold ourselves to these only. I don't agree with some parts of the report of the Committee. The fact is that most of the members of this Association get transportation, and we must consider the question of being able to get transportation. Two or three years ago we experienced some trouble and had to change our meeting place. Through courtesy and good feeling, the members of the Association went down to my town, Richmond, but we were forced on account of not being able to get transportation to Richmond to change the place of meeting.

The President: I believe it would be a good idea to bring it down to two places and then take a vote on it.

Mr. Elkins: As Chairman of the Committee, I beg to say we had no idea of cutting out any other towns that the members wished to be placed in nomination.

Mr. Hemphill: In order to get this mattter before the Convention, I move that the report be received and that an informal ballot be taken which will give the members an opportunity to name any city they please. If there be six voted on informally, the three lowest should be dropped and on the formal ballot the three highest be voted on.

Mr. Goodwin: Do I understood your motion is that any city can be placed in nomination?

Mr. Hemphill: Any city you choose.

The motion was seconded by several members and carried.

Mr. Hemphill: The three highest will be voted on formallv.

Mr. Goodwin: Are nominations in order?

The President: Yes.

A Member: I propose Niagara Falls.

Mr. Lucas: I propose Omaha.

The Chairman: We have not voted on the motion yet.

The question was put by the Chairman and the motion carried unamimously.

Mr. Wilson: I would like to place in nomination St. Louis. It is a good city and is centrally located. Nearly every railroad of any size has a trunk line connecting with it. The members will have no trouble getting into St. Louis. The Association has not met at St. Louis since I have belonged to it. It is right in the center of the country and from nearly every point a nice ride will put you into St. Louis.

Mr. O'Neil: Mr. President, I would ask for information. If there is any invitation from any of these cities, they ought to be read.

The President: It would not do us any good now.

Mr. Goodwin: As far as I am concerned, I am perfectly willing to go anywhere. Most assuredly I am only anxious to go where the will of this Convention indicates. While we are very much pleased that these cities have sent invitations, we cannot afford to go too far west, too far east, too far south nor too far north, if we expect to get the attendance we are looking for. It occurs to me if we stay in the middle west we will be more than compensated in the way of membership. I place in nomination a town that I do not suppose has given any invitation. I don't agree with Mr. Slate in reference to the large cities. The members of this Association have to remain at work in this Convention all the time regardless of what is taking place on the outside. I nominate Cincinnati.

Mr. Young: I place in nomination Chicago. That is centrally located and everybody can go there.

Mr. Patrick: I favor Chicago.

The President: We have Chicago.

On motion the nominations were closed and the Convention proceeded to ballot informally, Mr. Homer and Mr. Laughridge being appointed tellers.

Mr. O'Neil: With due courtesy to the cities placed in nomination I would suggest that these invitations be read and let the members know what the invitations are.

The Secretary read the invitations from Niagara Falls, Sandusky and Omaha.

Mr. O'Neil: Mr. President, I move that Denver be added to that list.

The President: The nominations are closed. It is too late.

The Secretary: Shall I continue the reading of the invitations?

Mr. Connor: That is enough. It is just a waste of time.

Mr. Wagstaff: Yes, it is a waste of time.

The Secretary: The Denver Convention League sends a very urgent invitation, indorsed by the Governor of the State, the Secretary of the Chamber of Commerce, and the Mayor of Denver.

Mr. O'Neil: Mr. President, I understand that some of the members have been misled. It was supposed that Denver was on the list.

The President: Did you nominate Denver?

Mr. O'Neil: Yes.

The President: All right, Denver is included. Now prepare a new ballot.

A Member: Denver was named in the report, and recommended by the Committee. Everybody understood that.

The President: We accepted the Committee's report, and afterwards a motion was made for the members to nominate any town they desired. I believe Mr. O'Neil nominated Denver and we did not hear it.

Mr. Hemphill: Denver was not omitted, and the report, which was accepted, included Denver.

The President: I made the mistake myself perhaps. We will ballot over again with Denver added.

Mr. O'Neil: I would like to make a motion that the invitations from Denver be read. There were several.

The Secretary: I read them.

Mr. Lowe: There were other cities mentioned in the report that are not on the blackboard. We may have to go all over it again. Buffalo is not on the board.

The President: Put Buffalo on the board, too.

Mr. Wilson: Washington, D. C., was in the report, too.

The President: Put on Washington, D. C.

A vote by ballot was taken which resulted as follows: Niagara Falls, 28; Omaha, 9; Denver, 19; Chicago, 13; Washington, 4; Cincinnati, 15; St. Louis, 9.

The Secretary: The three highest, Mr. President, are Niagara Falls, 28; Denver, 19, and Cincinnati, 15.

The President: We now ballot for Niagara Falls, Cincinnati and Denver.

The Secretary: I would like to ask if this is to be a formal ballot. Does this decide the question?

The President: We have three cities to ballot for. Do you wish this to be the formal ballot or ballot again for the two highest.

Mr. Patrick: Mr. President, I think this should be the formal ballot, provided one of these cities gets a majority of the votes cast.

The President: That is correct. Prepare the ballot.

A vote by ballot was taken, which resulted as follows: Niagara Falls, 42; Cincinnati, 41; Denver, 22.

The Secretary: Niagara Falls wins by one vote.

Several Members: No, no.

Mr. O'Connor: Denver is third in the race. I move that Denver be dropped, and we vote for the two cities that stand highest, Cincinnati and Niagara Falls.

The President: I thought that was the understanding. We will have to vote over again.

A vote by ballot was taken, which resulted as follows: Niagara Falls, 55; Cincinnati, 56.

The President: The City of Cincinnati, by a majority of one vote, is selected as the place of meeting for our next Convention.

Mr. Troy: I move that the vote be made unanimous.

Mr. Wagstaff: I second the motion.

The question was put by the Chair, and the motion carried unanimously.

Mr. Stafford: The supply men will be there.

GOOD OF THE ASSOCIATION.

The President: The next order of business is good for the Association.

Mr. Flavin: At the opening of this Convention our records showed 200 members in bad standing. That is not a very good showing. I think it is the duty of every one of the members present to appoint himself a committee of one to attempt to add one more member to this Association before our next Convention. I cover a broad section of the country, and if the Secretary will give me a list of the members who are in bad standing, I will guarantee they will have a hard time staying out until next Convention. I don't believe we work hard enough for the organization. If we would point out to the master boiler makers of this country the benefits to be derived from the Association, we could increase our membership 30 per cent by next Convention. I believe a copy of the proceedings of the Convention should be sent to anyone we think we could get in, and it would result in a great increase in membership.

The President: Mr. Flavin has done more to increase the membership of this Association than any other member I know of. He is always doing something for us.

The Secretary: In all probability—and the statement is made without much fear of successful contradiction—in the entire list of this Association no one has had to endure more worry and anxiety than the Secretary. In Cleveland three years ago in a measure you made me a boiler maker. At that time it was my privilege to tell you something about organization and how success for the consolidation that resulted in this organization was to be gained. Pardon me if at this time it is supplemented with the statement in this Convention that the seed it was sought to sow at that time did not fall on good ground. There has been a lack of cultivation essential to the reaping of a rich harvest. If you recall my words of that time, they were designed to drive home to every member that the sole secret of successful growth in membership was individual responsibility. In this connection, let me tell you a story. You had bullfrogs and bulldogs and various other things last night, and permit me to ring in St. Patrick's Day along with the Mulligan Guards of Boston, Massachusetts.

St. Patrick's Day was approaching and the Guards had a meeting. It was called for the purpose of determining whether it would be wise to parade on St. Patrick's Day, and the President called for motions and expressions of opinion. One member arose and said, "Mr. Prisident, I think it is quite in order that the Mulligan Guards, of Boston, Massachusetts, turn out on St. Patrick's Day and show their strength in the community. I move you that we have a procession, that we hire a band of music, and that an appropriation of $75.00 be made from the treasury to pay for the music, and Father Murphy can walk ahead of the procession on a horse. (Laughter.) Then he sat down.

Another member arose and said, "Mr. Prisident, I am entirely in sympathy with the gentleman who has just sat down after making those beautiful remarks; but, sir, we ought not to engage in any extraordinary extravagance, and I think that is what it amounts to, considering the condition of our treasury, to go out and hire a band of music for the procession. I think it is quite in order that we should turn out to show the strength of the Mulligan Guards of Boston, Massachusetts, in the community, but I think we will do just as well if we vote $50.00 for a fife and drum corps." (Laughter.) And he sat down.

A third man arose and said, "I am entirely in accord with the speakers and especially the last one; I do not believe in making any extravagant appropriation. Mr. Prisident, I have made up my mind that it would do just as much good to spend $25 and have a string band." (Laughter.) And he sat down. And then a little veteran of the organization with whitened hair arose, and with a quavering voice said, "Mr. Prisident—" and, like we hear in this Convention sometimes, somebody said "Louder." "Mr. Prisident, I am in favor of the procession. I think it is all right. We ought to have a parade to show the stringth of the Mulligan Guards in the community. I am also entirely agreeable to the idea that we ought not to have this extraordinary expenditure of money. I move you that we abandon the idea of having music, and have a calcium light. (Laughter.) That broke the backs of the other speakers, whereupon another venerable member said:

"Mr. Chairman, I am a great admirer of the intelligence of the gentleman that moved to have a parade of the Mulligan Guards of Boston, Massachusetts, on St. Patrick's Day to show their strength in the community, and Father Murphy walking ahead of the procession on a horse. I have listened to the motions and talk about spending money in the proper way, and we ought to indulge them; but the last speaker, I am sorry he said what he did, because it looks to me like I am showing him disregard; but I want the members of this organization to know that I respect him to the limit, but I want to know, Mr. Prisident, if we are going to have this parade to show our strength in the community, how in hell are you going to get any music out of a calcium light." (Laughter and applause.)

Now, then, how are you going to bring up this organization and increase its membership by simply shining before them and making no music? Have your parade, but when you parade, use your music, which will make the advantages of the Association apparent to every boiler maker in this country. Make your music so loud that he will be unable to forget it, and keep it up. Keep dinning it in their ears until they have no other refuge except this Association. Then each will plank down his five dollars, and have an application presented to the Association, indicating that he wishes to enroll and be among a lot of good fellows. (Applause.)

Mr. Doarnberger: We are speaking about increasing our membership and particularly the attendance at our annual meetings. We all know there is a scarcity of foremen of contract shops. I don't believe there are five in this meeting. I believe it would be a good idea to have a representative go to Detroit in August and place before the Manufacturers' Association the necessity of sending their foremen here. Only one thing keeps them away. The foreman boiler makers of the railroad shops have the advantage of transportation, and many of us are being reimbursed for our expenses, where they have to foot the whole bill. I therefore move, and I hope the Association will see fit to concur, that we send a delegate to Detroit to the Manufacturers' Association to urge them to have their foremen attend these conventions.

The President: We have a member in this organization who is also a member of the Master Mechanics' organization, and I don't know a better man in the world to send to the Master Mechanics' Convention with this object in view—to urge them to send their foremen to our Convention. These foremen are willing to come, as just stated, but they have to pay their own expenses, and in addition to that, it is not agreeable at all times to their employers to allow them to go to the Convention or they do not care to sacrifice the time. The member I refer to is Past President Wagstaff. I believe it would be a good idea to delegate him to take this matter up with the manufacturers and try to induce them to send their foreman boiler makers to our Convention.

Mr. Lucas: Mr. Doarnberger's remarks and motion referred to the manufactu rers, the contract manufacturers, and not to the Master Mechanics.

The President: I meant the manufacturers, the American Manufacturers' Association. I believe it would be wise to have Mr. Wagstaff delegated because he is a member of the Master Mechanics' Association.

Mr. Kelly: I move that this Association send Mr. Wagstaff.

Mr. Flavin: I second the motion.

The question was put by the Chair and carried unanimously.

Mr. Wagstaff: Mr. President and fellow members of the International Master Boiler Makers' Association: If we send a delegate to the Manufacturers' Association to join with them in their Convention, who is to have uppermost in his mind the representing of our organization and to plead with those gentlemen to see that their foremen are encouraged to join our organization, he should be a representative man, someone who understands why the manufacturers are meeting and is acquainted with many of them, so that he could do some personal work. I believe if you consider the duties incumbent upon this delegate, you would perhaps want to change your mind and send somebody that could represent the Association more efficiently than your humble servant. However, if it is your wish to have me go, I assure you that the interests of this Association will be uppermost in my mind at all times, so that we may have more foremen of the manufacturers' shops with us in the future.

Mr. Doarnberger: I believe it would be proper for our Secretary and President to communicate with the Secretary and President of the Manufacturers' Association in regard to Mr. Wagstaff's recognition there.

The President: That will be done.

PRESIDENT CONRATH'S VALEDICTORY.

The President: As the time for the final adjournment of this Convention is near, this will perhaps be my last opportunity to express to you my sincere thanks, especially to the committees, officers and Executive Board for the loyal support given me during the year. I do not want to detain you very long, but I do feel indebted to the committees, the Executive Board and its able Chairman. If there has been any success in the past year, the credit is due to them and to our Secretary. They have exerted themselves to make this organization and especially this Convention, a success. If there is any credit, it is due to them for their untiring energy. I have been with you and shall be, heart and soul, as long as I am here. This work appeals to me at all times. Your occupation carries with it large responsibilities. It is a worthy one. It is one that needs a little more than ordinary intelligence and ability. We all realize how important boiler work is. Improvements are being made from one end of the country to the other, and it is necessary to keep pace with them. Our studies and our work must be continuous. Our work is not from sunrise until sunset, but for all time. That we have to learn as long as we are here is plainly evident to my mind, for I have been in the business 22 years and I am still learning. Your work requires very close attention. Don't sacrifice quality for quantity. Prepare your work carefully and make very close inspections, for you know the results of poor workmanship and poor inspection. Your work is not before your eyes like that of other mechanics, but you are obliged to jump into fireboxes and crawl into shells in order to ascertain that it is safe and sound, before you allow it to leave your hands. Never lose sight of the factor of safety. Keep it before you at all times. Your organization will grow from time to time with the proper officers and energetic members. You will carry it step by step to the highest point of efficiency. Accept my sincere thanks once more for the loyal support given me during the past year. The committeemen who took part with me in the work, labored untiringly. They sacrificed both time and money. Nearly all their leisure hours were devoted to the Association. Give the same support to the newly elected officers, for without it their efforts will be of no avail. It is not possible for one man to take hold of an organization like this and carry it on to success. Each and every one of you when you go home should not consider that your work has been done, but keep on working, and when asked by mail to support some committee, to make some suggestion or give your experience, kindly do so and help to promote the best interests of the Association. By doing this you will in time have one of the finest organizations there is in the mechanical world. I thank you. (Applause.)

ELECTION OF OFFICERS.

The President: We will proceed with the election of officers if there is nothing else to be said as to good of the Association.

Mr. Goodwin: I feel very much complimented by what the President has said in expressing his appreciation of the work done. As one of the committeemen, I feel very gratified indeed. The President gave the committees all the support within his power and was always faithful in every sense of the word. I believe the Chairman of the Executive Board comes in touch with the working members of the organization a little more closely than anyone else with the exception of the Secretary. In fact, as you are all aware, chiefly all the business passes through the Secretary's hands, with which the Executive Board is in touch. We have a Vice-President who is one of the ablest, one of the truest, and one of the sincerest men with whom I have ever had the pleasure of being acquainted. We have a punch here that we expect to punch him with. It has been presented by the Cleveland Tool Company. We have been honored in many respects by the people of Louisville, in extending to us the hospitalities of this beautiful city, and to show the appreciation of the members of this Association, I wish to place in nomination for President one of the biggest men I ever met, in heart and voice, though small in stature, Mr. Arthur E. Brown. (Applause.)

Mr. Gray: I nominate Mr. A. M. Lucas of Milwaukee.

Mr. Laughridge: I move the nomination be closed.

The motion was seconded by several members and carried.

Mr. Lucas: I would like to say a few words.

The President: You cannot now. It is too late.

A vote by ballot was taken which resulted as follows:

Total number of votes cast, 87; Brown, 68; Lucas, 19.

The President: Vice-President Arthur E. Brown is elected as your presiding officer for the next 12 months.

Mr. Lucas: I move that the Secretary be instructed to cast the vote of the Association for Arthur E. Brown as President, to make it unanimous.

The motion was seconded by several members and carried.

The Secretary cast the ballot and Mr. Brown was declared the unanimous choice of the Association for President for the ensuing year.

Mr. Brown: Mr. President, permit me to stand on the common level.

The President: No, come up on the platform where you belong. (Laughter.)

Mr. Brown: Mr. President and kind friends of the Association, I say kind from the fact that you are kind, from the fact that you have been kind, and from the fact that I know you will always be kind. I trust that I may merit your confidence and be worthy of the honor you have bestowed upon me. I trust that in the ensuing year I will give you no cause to regret this act. I did not solicit the presidency of your Association, but I believe in abiding by the will of the members. I hope during the ensuing year the retiring officer will give me all the assistance I may need, and I am sure he will. I carried the message to the Association last evening to extend to whoever you made President the helping hand. As your President, I shall put forth all the energy I can to make the convention which convenes in Cincinnati a year from now a success. I thank you, gentlemen, and will add to that my thanks to the Cleveland Tool Company, which has remembered me so kindly with this little paper weight. I trust that health and prosperity will prevail over the Association until we meet again, and in conclusion may "God be with you till we meet again." (Applause.)

The President: (Mr. Brown in the chair.) Next in order will be the election of the First Vice-President.

Mr. Laughridge: I nominate our worthy Third Vice-President, who does not need an introduction, Mr. A. M. Lucas, for First Vice-President.

Mr. McKeown: Sir, I nominate Mr. C. A. Lester.

Mr. Bowman: I move the nominations be closed and we proceed with the balloting.

The motion prevailed and ballot was taken which resulted as follows:

Total number of votes cast, 70; Lucas, 53; Lester, 17.

The President: Your choice for First Vice-President is Mr. Lucas of Milwaukee.

Mr. Lester: I move that the vote be made unanimous for Mr. Lucas. Carried.

The Secretary cast one ballot for the Association unanimously electing Mr. Lucas First Vice-President.

Mr. Lucas: Mr. President and fellow members, I assure you that I appreciate the honor of being elected First Vice-President of this Association. I am proud to be one of you. I am proud of my running mate. I have admired him for the last four years, and I assure you I will work in harmony with the officers elected as well as the members of the Association, and it will be my pleasure to do all I can at all times. (Applause.)

The President: Next in order will be nominations for Second Vice-President.

Mr. Conrath: I wish to place in nomination for Second Vice-President one of our worthy members who has labored with us for many years, who has proven very valuable during the past year. He was Chairman of the Committee on Rules and Formulae, and he has presented an able paper to this Convention. I nominate Mr. Charles P. Patrick. (Applause.)

Mr. Elkins: I move the nominations be closed and Mr. Patrick elected Second Vice-President.

The President: Mr. Charles P. Patrick has been placed in nomination for Second Vice-President, and it has been moved and seconded that the nominations be closed.

The question was put by the Chair and carried unanimously.

Mr. Conrath: I move that our Secretary cast one ballot for Charles P. Patrick, for Second Vice-President.

Mr. Letteri: I second the motion.

The question was put by the Chair and carried unanimously. The Secretary cast one ballot for the Association unanimously electing Mr. Patrick Vice-President.

Mr. Patrick: Mr. President and fellow members, I feel very much flattered by your selection of me as Second Vice-President. I beg to assure you that I will be with you and the Association during the coming year as I always have been since I became a member. (Applause.)

The President: Next in order will be nominations for Third Vice-President.

Mr. Linderman: If I am in order I desire to place in nomination the name of a man who is not here for the office of

Third Vice-President, who was unavoidably detained. I know his heart is with the Association. I nominate Mr. George W. Bennett.

Mr. Smythe: Our Constitutions and By-Laws prohibit that. I am a close friend of Mr. Bennett, but I think that would be violating the Constitution and By-Laws.

The President: It was done before, I think, under similar circumstances, Mr. Smythe. I think the Convention should set aside the rules in favor of Mr. Bennett, because he was unavoidably detained.

Mr Smythe: Then, Mr. Chairman, I move that we suspend the rules.

Mr. Elkins: I second the motion.

Mr. Wanberg: We have with us a man who, I believe, would fill the office very satisfactorily, and I place in nomination Mr. Wratten, of Racine, Wis.

Mr. C. J. Murray: I place in nomination Mr. C. E. Lester for Third Vice-President.

Mr. Wagstaff: I move the nominations be closed. Carried.

A vote by ballot was taken, with the following result:

Total number of votes cast, 49; Bennett, 17; Wratten, 17; Lester, 15.

A member: We have sent a delegate to the Manufacturers' Association and Mr. Wratten is a contract man. Wouldn't it be well if we put him in as one of our Vice-Presidents.

The President: We will have to take a new ballot for Mr. Bennett and Mr. Wratten.

A second ballott was taken with the following resutl:

Total number of votes cast, 53; Wratten, 36; Bennett, 17.

The President: Mr. Wratten, having the largest number of votes, I declare him elected Third Vice-President.

The President: Nominations for Fourth Vice-President are now in order.

Mr. Gray: I wish to place in nomination for Fourth Vice-President Mr. Lowe, of Winnipeg, Can.

Mr. Wilson: I move the nominations be closed.

Mr. Laughridge: I second the motion. Carried.

Mr. Wilson: I move the Secretary cast one ballot for Mr. Lowe.

Mr. Laughridge: I second the motion.

The motion was carried unanimously, and the Secretary cast one ballot for the Association unanimously electing Mr. Lowe Fourth Vice-President.

The President: Next in order will be nominations for Fifth Vice-President.

Mr. Goodwin: Owing to the valuable services one of our members has rendered, to my knowledge, during the last four or five years, and who would be present with us today if it was not for his inability, I really think it would be a mistake for us to overlook our former Fifth Vice-President, Mr. George W. Bennett. I hope it is the will of this Convention that he be nominated.

Mr. Smythe: I move the nominations be closed, and the Secretary cast a unanimous ballot for Mr. Bennett for Fifth Vice-President. Carried.

The Secretary cast one ballot for the Association unanimously electing Mr. Bennett Fifth Vice-President.

The President: Next in order will be nominations for Secretary.

Mr. Goodwin: I want to explain myself for getting up this time. I don't want the members to think I want the honor of placing first one man in nomination and then another, any more than they do, but during the year just gone by, I don't believe the members of this Association can fully comprehend what an efficient Secretary we have at the present time. Nearly every mail has brought me a business letter from Mr. Vought. I nominate Mr. Vought for re-election as Secretary.

Mr. Conrath: I move that the nomination be closed and the Association unanimously re-elect our Secretary, Mr. Vought. Carried.

The question was put by the Chair, and the motion carried unanimously by a rising vote.

The President: I declare Mr. Harry D. Vought Secretary of the International Master Boiler Makers' Association for the ensuing year, having received the unanimous vote of this Convention.

The President: Next in order will be nominations for Treasurer.

Mr. Conrath: I wish to place in nomination one who has ably filled this office for the past four or five years, one of the most able men I believe we have in our Association, is a conscientious worker and has proven himself worthy, and I place in nomination the present incumbent, Mr. Frank Gray, from Bloomington.

On motion of Mr. Laughridge the nominations were closed and by direction of the Convention the Secretary cast the deciding ballot for Mr. Gray.

The President: Mr. Gray, having received the unanimous vote of this Association, I declare him re-elected as Treasurer for the ensuing year.

The President: Can we vote the three members of the Executive Board as a whole?

Mr. Goodwin: I don't know whether that would be a good idea or not. I understand the terms of Mr. Rogers, Mr. Laughridge and Mr. Crombie now expire. As Chairman of the Board I want to say something in reference to the members of that Board. We must appreciate the necessity of having working members on the Executive Board, men who are willing to sacrifice time and effort to accomplish the work that comes before this Convention. I think it would be well, therefore, for you to elect those members singly; having old members on the Board who take an interest is a great assistance in getting your papers in proper conditions. I don't think it is wise for us to be changing members every year. I want to call your attention especially to the fact that we have with us today Mr. Laughridge and Mr. Crombie, both faithful workers, and undoubtedly it ought to be the will of the Convention to return them for the three year term.

The President: Do you make that as a motion, Mr. Goodwin?

Mr. Goodwin: If I am in order, I nominate both of them.

Mr. Letteri: I second the motion.

Mr. Goodwin: It devolves upon the Convention to nominate one more.

Mr. Doarnberger: We have with us a member who has always been faithful in the discharge of the duties conferred upon him. I therefore place in nomination in place of Mr. Rogers, Mr. Sarver of Fort Wayne.

Mr. Letteri: I move that these three be considered the nominees and that the Secretary cast one vote for them. Carried.

The Secretary cast one ballot for the Association unanimously electing Mr. Sarver and re-electing Mr. Crombie and Mr. Laughridge, members of the Executive Board for the ensuing three years.

The President: The Secretary having cast the vote, I now declare Messrs Laughridge, Sarver and Crombie members of the Executive Board for the ensuing three years.

Mr. Goodwin: Before we adjourn I move we say good-bye to all.

Mr. Doarnberger: Let us all join in singing Auld Lang Syne.

It was moved and seconded that the Convention adjourn sine die, and the question being put by the Chair and a vote being taken, the motion was carried unanimously, whereupon the members joined in singing Auld Lang Syne and the Convention was declared adjourned.

OFFICERS FOR 1909-1910

PRESIDENT,
A. E. BROWN,
L. & N. R. R., Louisville, Ky.

FIRST VICE-PRESIDENT,
A. N. LUCAS,
C., M. & St. P. R. R., Milwaukee, Wis.

SECOND VICE-PRESIDENT,
CHARLES P. PATRICK,
Gen. Supt., The Bigelow Co., New Haven, Conn.

THIRD VICE-PRESIDENT,
HENRY L. WRATTEN,
Supt. Boiler Dept., Freeman & Sons, Mfg. Co., Racine, Wis.

FOURTH VICE-PRESIDENT,
THOMAS W. LOWE,
Winnipeg, Manitoba.

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"BEST METHOD OF APPLYING FLUES. BEST METHOD OF CARING FOR FLUES WHILE ENGINES ARE ON THE ROAD AND AT TERMINALS AND BEST TOOLS FOR SAME."—D. A. Lucus, Chairman, Havelock, Neb.; E. W. Young, Dubuque, Ia.; John German, Kankakee, Ill.; Clarence L. Wilson, Memphis, Tenn.; Fred D. Avery, Keene, N. H.; J. R. Cushing, Bellfontaine, O.

"FLEXIBLE STAYBOLTS COMPARED WITH RIGID BOLTS. BEST METHOD OF APPLYING AND TESTING SAME."—Charles J. Murray, Chairman, Meadville, Pa.; H. J. Wandberg, Minneapolis, Minn.; W. G. Stallings, McComb, Miss.; J. P. Malley, Springfield, Mo.

"STEEL VS IRON TUBES. WHAT ADVANTAGES AND WHAT SUCCESS IN WELDING."—M. O'Connor, Chairman, Missouri Valley, Ia.; John McKeown, Galion, O.; B. F. Sarver, Fort Wayne, Ind.; D. G. Foley, Green Island, N. Y.; C. L. Hempel, Omaha, Neb.; M. M. McAllister, Cleveland, O.

"CAUSE OF FLUE HOLES IN BACK FLUE SHEET ELONGATING AND A PREVENTIVE FOR SAME."—J. A. Doarnberger, Chairman, Roanoke, Va.; E. J. Hennessy, Depew, N. Y.; John B. Smith, McKees Rock, Pa.; William A. McKeown, Buffalo, N. Y.

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"WHAT RADICAL DEPARTURES ARE BEING MADE IN BOILERS AND FIRE BOXES."—B. F. Sarver, Chairman, Fort Wayne, Ind.; J. H. Smythe, Pittsburg, Pa.; A. N. Lucas, Milwaukee, Wis.; Charles P. Patrick, New Haven, Conn.; F. A. Mayer, Washington, D. C.

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"BEST METHOD OF STAYING FRONT PORTION OF CROWN SHEET ON RADICAL TOP BOILERS TO PREVENT CRACKING OF FLUE SHEET IN TOP FLANGE."—Henry J. Raps, Chairman, Chicago, Ill.; A. N. Lucas, Milwaukee, Wis.; J. H. Filcer, Indianapolis, Ind.; Frank Gray, Bloomington, Ill.; M. H. Larkin, Memphis, Tenn.

"PROPOSED CHANGES IN CONSTITUTION AND BY-LAWS."—Charles P. Patrick, Chairman, New Haven, Conn.; William H. Laughridge, Columbus, O.; Thomas W. Lowe, Winnipeg, Manitoba, Thomas Werner, Coatsville, Pa.

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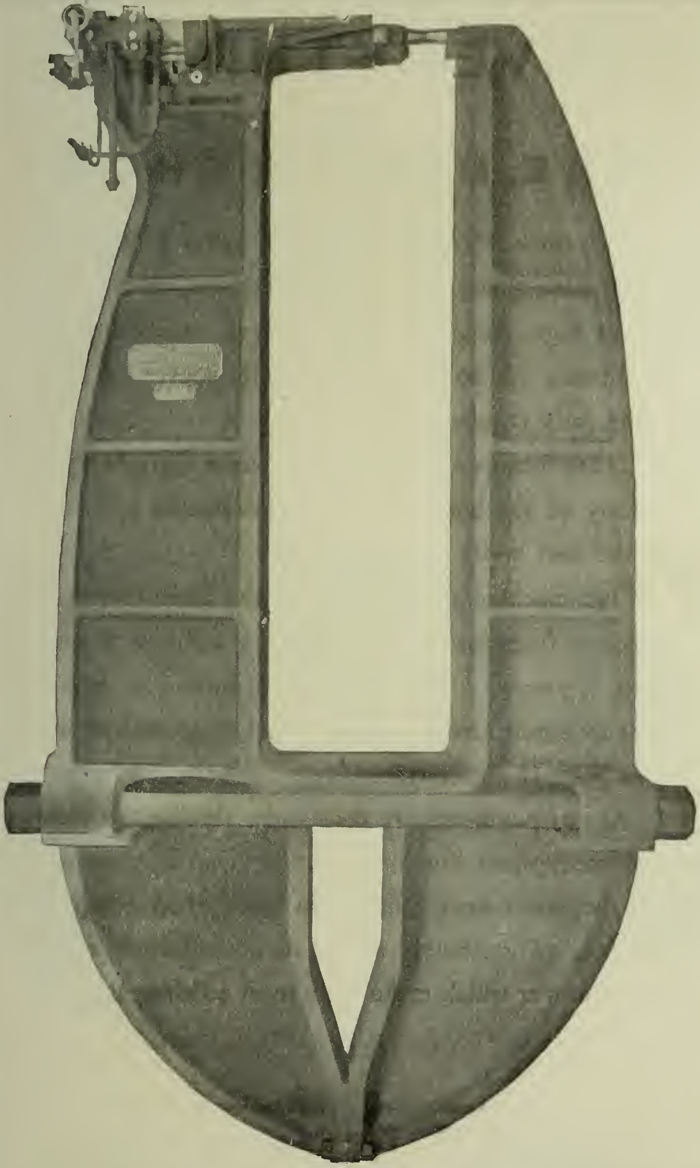

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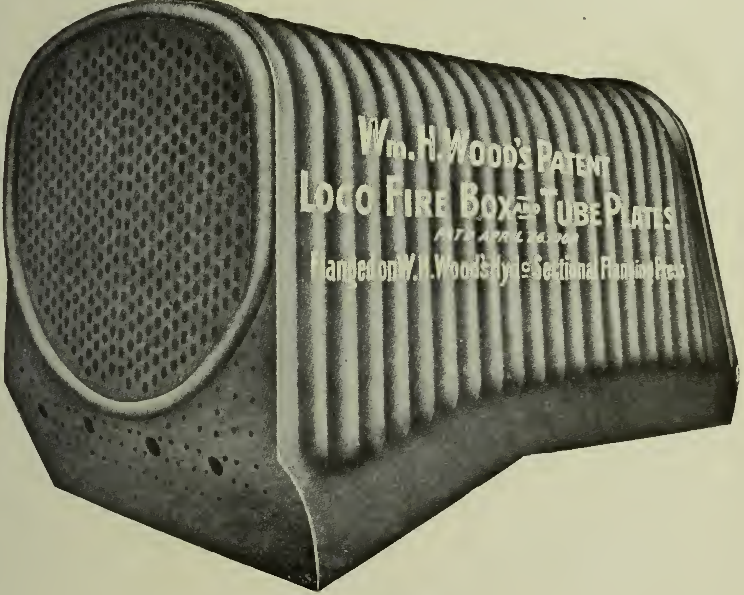
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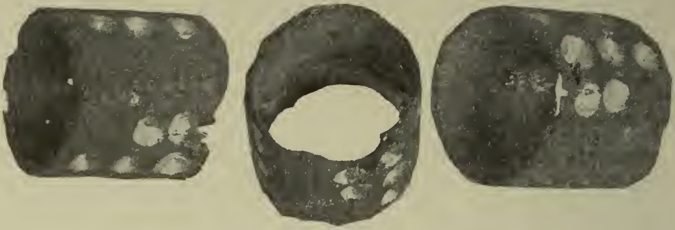

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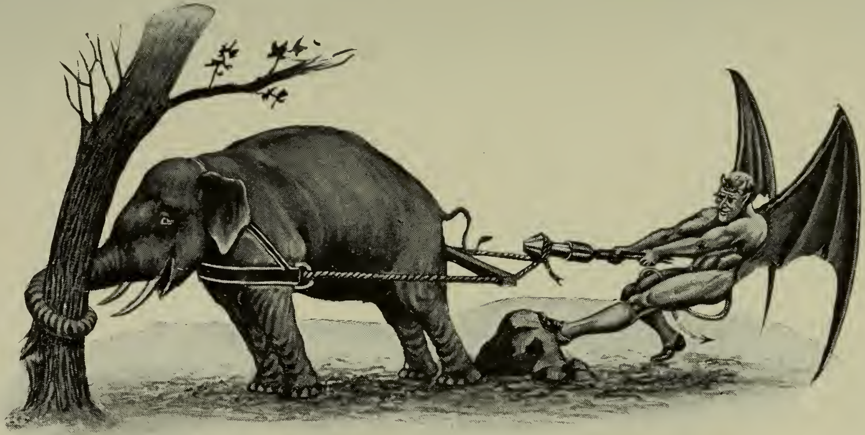

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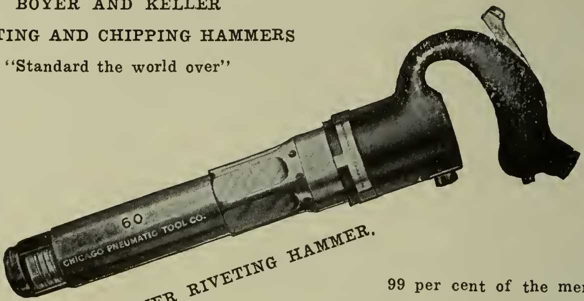

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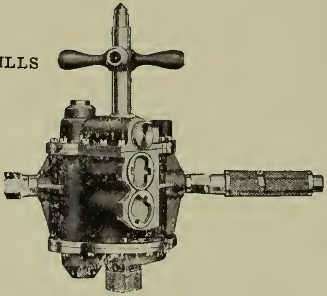

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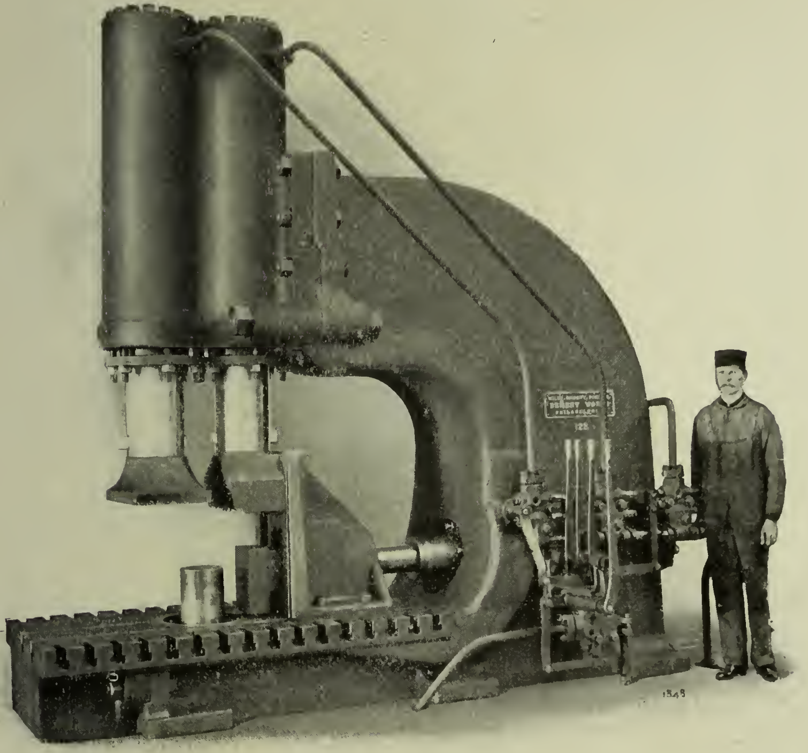

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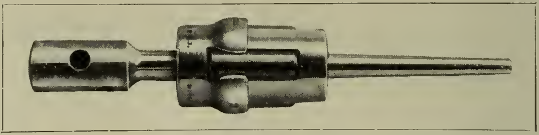

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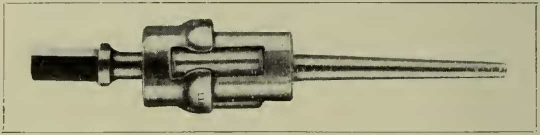

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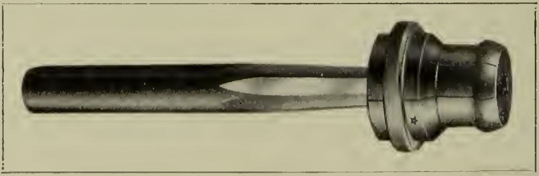

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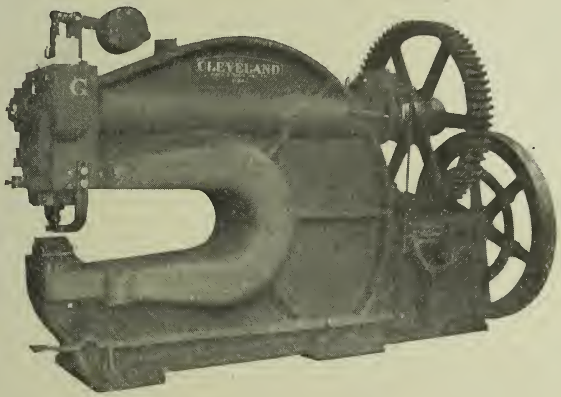

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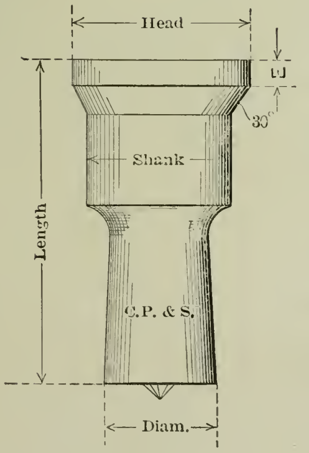

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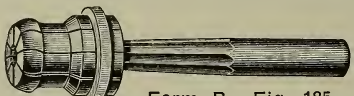

Form B. Fig. 185.

Fig. 39.

Fig. 40.

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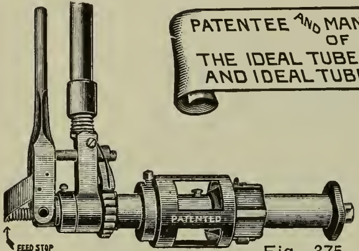

Fig. 375.

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